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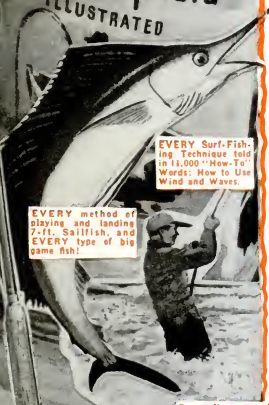

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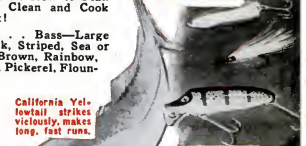

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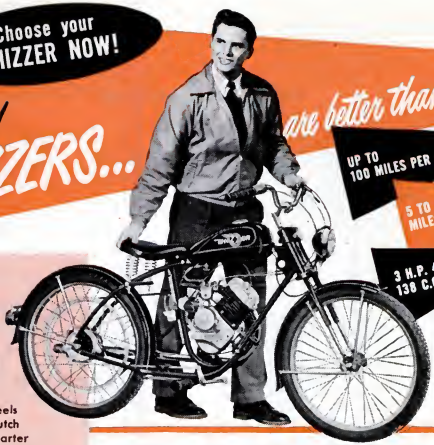

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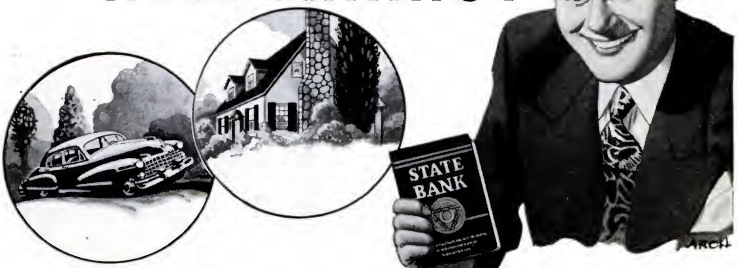

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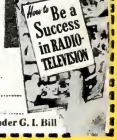

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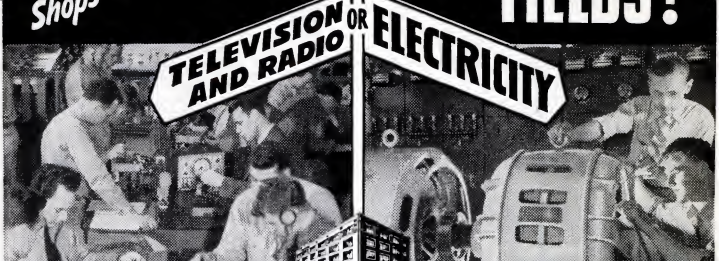

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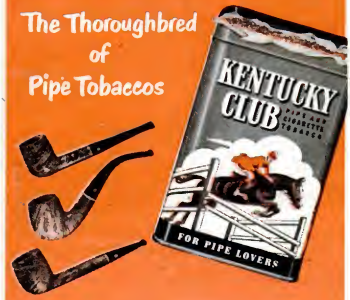

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Letters

Still a Good Idea

Sir:

Wilbur Shaw's report on the '51 Pontiac in your January issue [p. 109] contains this paragraph:

"Firing up still seems to be a two-handed job . . . you turn the switch with your right hand and press the starter button with your left. Why don't more manufacturers follow Ford and put the two together on the left?"

What I want to point out is that Chrysler Corporation has had this kind of starting ever since 1949 on all models, even Plymouth.

PAT BARLOW

Austin, Texas

Sir:

. . . Plymouth and the other Chrysler cars had key-turn starters in 1949.

KENNETH YODER

Akron, N. Y.

Sir:

. . . Studebaker had it in the early '20s.

EVERETT SEEDS

Hutchinson, Kan.

You're quite right. As a matter of fact, Studebaker went Chrysler one better in 1936 when they introduced their "Startix" starter—an ignition-key starter that restarted the engine automatically if it stalled. But Mr. Shaw's suggestion that more auto makers adopt the idea still stands.

Essex Owner Seeks Companionship

Sir:

I was particularly interested in the article on the F-head engine in your November issue [p. 152], especially the picture of the 1919 Essex. For I've just become the proud possessor of a beautiful 1920 Essex touring car—top in perfect condition, tires good, paint good, leather seats very little worn.

I picked the car up from the original owner, who'd had her up on blocks since she was last driven in 1939. I put in a new battery and cable, cleaned the spark plugs, changed the oil and greased her—and she started right up and purrs like a kitten.

Now I'd like to get in touch with others

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

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TRUMAN J. FISHER

Urbana, Ohio

Paying Attention to Business

Sir:

In your January, 1951 issue John F. Loosbrock claims that when you pull the lanyard you "cock and fire the piece."

While I spent most of my two months of service with Battery K, 18th Field Artillery, in applying coats of whitewash to the battery latrine at Fort Bragg, I saw enough of the 105-mm. howitzer to realize that the

piece was cocked automatically when you opened the breech. As a safety feature, you cannot fire the piece—release the firing pin—unless the breech is closed.

JOHN L. SULLIVAN

The Bronx, New York

Reader Sullivan must have been paying closer attention to his whitewash than the guns, because the Army has never issued a 105-mm. howitzer with an automatic self-cocking arrangement. Possibly Mr. Sullivan saw an experimental model, but no such gun is, or ever has been, in general use.

19th Century Electric Trains

Sir:

"The first model electric train was made in 1835 by the inventor of the electric motor, Thomas Davenport . . . In the 1890's, Ives & Williams sold electric trains . . . Carlisle and Finch had been manufacturing electric trains since the fall of 1896 . . ."—Hertz, Louis H., in the books, "Riding the Tinplate Rails," and "Messrs. Ives of Bridgeport."

JOHN C. KLIER

Relay, Md.

Thanks to Mr. Klier for these historical notes, which are at variance with informa-

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

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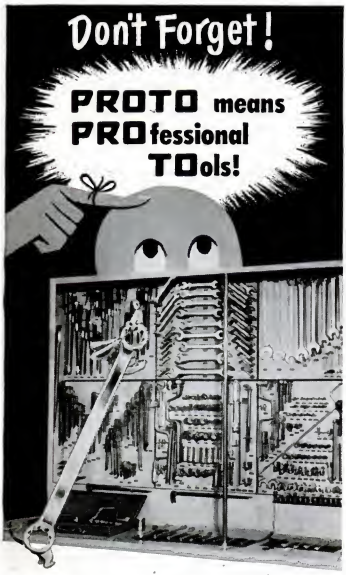

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tion provided PS by Lionel stating that a 1900 Lionel toy electric train was the first (PS, Dec. '50, p. 83).

000000000?????

Sir:

In your November 1950 issue, page 18 under the heading "MOUTHFUL" you give two ways of reading 500,000,000,000,000,000,000,000,000,000,000,000,000,000,000. The first expression while being accurate is unduly cumbersome. Why say "five hundred thousand trillion trillion trillion" when it is so much simpler to say five hundred duodecillion? Usually 500,000,000,000 is read five hundred billion, not five hundred thousand thousand thousand.

WILLIE E. WALL

New Orleans, La.

We'll go along with you, but only if you remember that this holds true only in the American and French systems. In the English system, a duodecillion is 10 to the 72nd power, rather than 10 to the 39th power—a much bigger figure. How much bigger? Just 1,000,000,000,000,000,000,000,000,000,000,000 times bigger!

How to Rock a Mercury

Sir:

Wilbur Shaw in writing about the Mercury automatic transmission in your December issue, page 94, states that the car is hard to rock in sand or snow. The car will rock very easily if the selector lever is moved back and forth between Low and Reverse. Mr. Shaw's mistake, apparently, was in trying to rock the car by moving the selector back and forth between Drive and Reverse, which is a very difficult way of doing it.

GEORGE E. THORNHILL

Stamford, Conn.

In a Mercury, you go through Drive to get from Reverse to Low. Though it takes longer to make this shift, you do get more torque.

Too Many Starters

Sir:

In your December 1950 issue on page 230 of "Gus Fixes the Local Scrooge," you said Stan took his *finger* off the starter button. On page 232 you said Purcell pressed

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his *foot* on the starter. Are there two starters on the car?

DALE RABE

Michigan City, Ind.

No, the car hasn't got two starters—Martin Bunn's just got two heads.

Blame the Russians

Sir:

In the January '51 issue of POPULAR SCIENCE, you have a cover showing three Russian jets. The first of the jets, the Mi 1, has the RK-25 markings on it. I am not up to date on my Russian, but the letter "R" seems to be reversed. This may be a mistake, or Russian.

PAUL MOLCHAN

Parma, Ohio

The apparently reversed "R" is the Russian vowel sound for "YA." Combined with "K," pronounced as in English, this produces the word "Yak," which is the plane's name.

PS Gets "Kohl" Shoulder

Sir:

Re the letter to the Editor on page 16, December 1950 issue, concerning the color of the President's new Lincoln convertible—you are both in error. Your description should have been that the car was *kohl* black. A widely available but little used volume, the dictionary, will support this information.

ANN OHNIMUS

Northridge, Calif.

Not our dictionary. Webster gives "kohl" as a sooty cosmetic mixture used by women—in other words, mascara. It is not used as an adjective to describe a color.

Both Right

Sir:

In your January issue, pages 90 to 95, you stated that the F-80 and the F-86 are armed with four 20-mm. cannon.

I say that they are armed with six 50-cal. machine guns. Who's right?

RONALD OSSEGE

Dayton, Ohio

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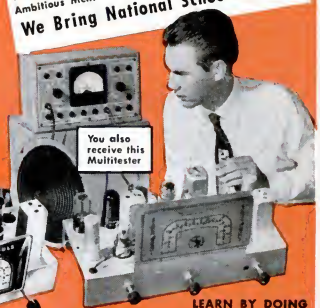

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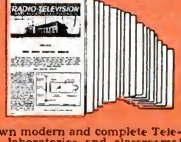

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cannon, while others have six 50-cal. machine guns. The particular planes PS was talking about in that issue were those equipped with cannon.

How to Get TV Dx

Sir:

There are quite a few POPULAR SCIENCE subscribers here who would appreciate more dope on the gentleman from Pennsylvania who is getting such wonderful reception on his television set. (PS, Feb. '51, p. 210). How does he do it?

DR. WILLIAM A. WIESE
Jackson Center, Pa.

He is Burns J. Tobias of Millersburg, Pa. He uses a DuMont 30-tube receiver permanently connected to two two-tube boosters in simple tandem, plus an elaborate three-section antenna. The uppermost antenna is a five-element Yagi cut for Channel 4, the middle one a four-element beam cut for Channel 10, and the lowest a five-element Yagi on Channel 6. The entire structure is mounted on a rotatable base on top of a 75-foot mast. Separate down-leads are provided.

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MacGregor's Cleats

Sir:

I am very much amazed and chagrined over the article on page 155 in the February edition of POPULAR SCIENCE entitled "Ring Cleats Prevent Football Spills."

In this article, the development of the Ring Cleat is credited to the Wilson Sporting Goods Co., of Chicago. The Wilson Sporting Goods Co. have absolutely no connection whatever with the ring cleat. As a matter of fact, the ring cleat was developed by the Cornell Aeronautical Laboratory for our company, MacGregor Goldsmith Inc., and is solely manufactured by us. . . .

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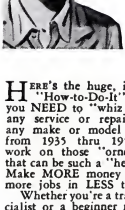

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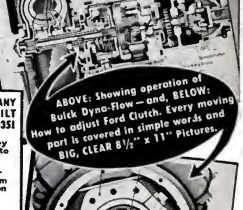

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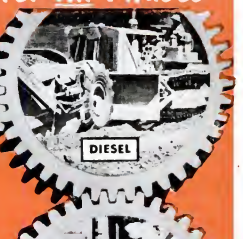

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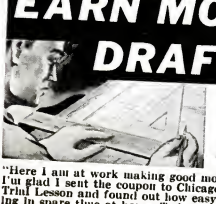

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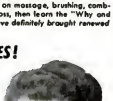


AFTER

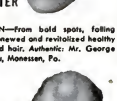
MUSICIAN—From bald spots, falling hair to renewed and revitalized healthy scalp and hair. *Authentic:* Mr. George Compeau, Monessen, Pa.

BEFORE

AFTER

STEEL WORKER—From almost total baldness to a head of handsomely healthy hair by the Genco Method. *Authentic:* Mr. Nick Podolochak, Pgh., Pa.

BEFORE



AFTER

Yes, you'll want to learn for yourself how you, same as thousands of other men and women can definitely enjoy the regaining of revitalized hair & scalp health by professionally-tested-and-proved use of the Genco formula. The exclusive Genco treatments using these formulae will convince you it can be done! They're not overnight "CURE-Alls" but scientifically-planned formulae that go to the "root" of your baldness trouble and do the job of stopping falling hair, dandruff, etc.

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IF BALDNESS WORRIES YOU—Act NOW! Don't be discouraged because other "techniques" have failed to do what Carl Genco can do for you. Our low introductory kit $1.5 price is little to pay to regain hair.

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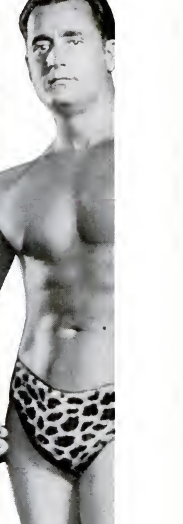

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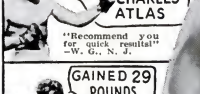

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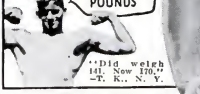

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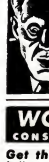

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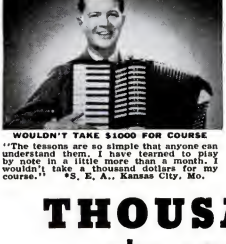

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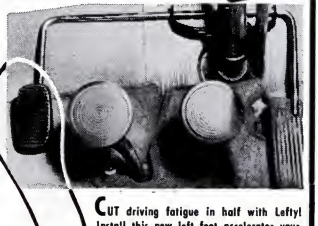

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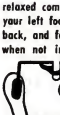

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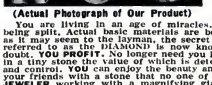

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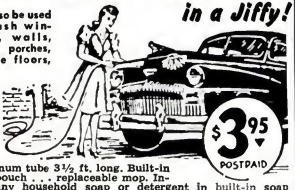

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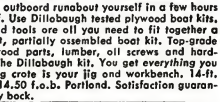

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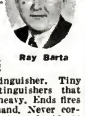

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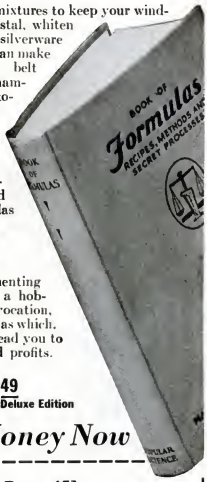

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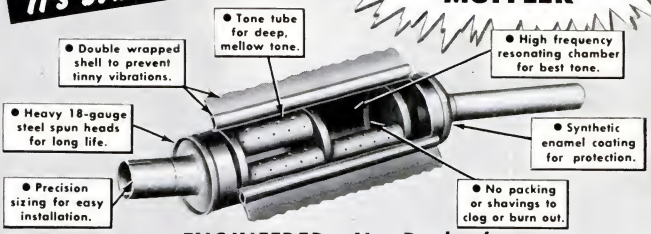

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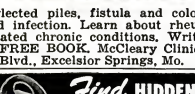

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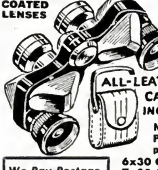

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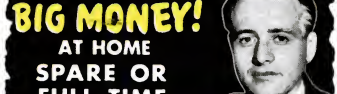

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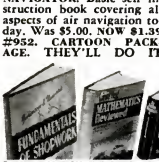

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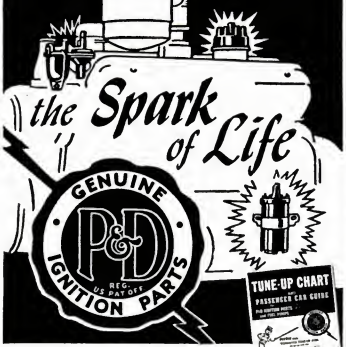

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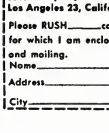

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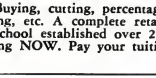

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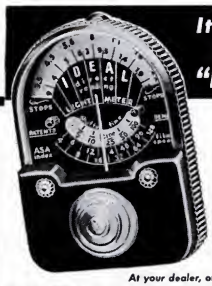

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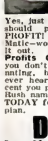

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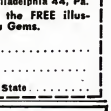

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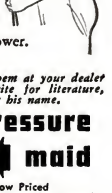

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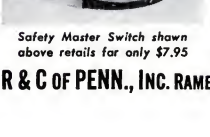

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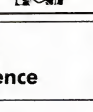

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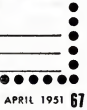

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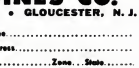

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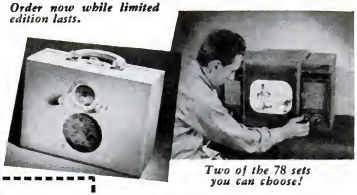

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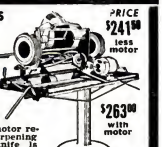

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PENNY Approvals—many countries. C. Reitter, Box 1505, Detroit, Michigan.

U.P.U., Korea, Persia, Turkey, Free With Approvals. Orange Stamp, Box 3169, Miami 20, Florida.

"MONACO Nudes" 10c. Approvals accompany. Royal Stamp Company, Tamaqua 2, Penna.

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FREE—Illustrated Catalog! Kenmore, Richford C-58, Vermont.

307 ALL Different—Only 15c! Beautiful collection: Commemoratives, Triangles, High Values, Bicolored Stamps, etc. Garcelon, Calais 418, Maine.

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42 HOBBIES, COLLECTIONS

INVENTING can be an interesting and profitable hobby. Write for complete particulars. Institute of American Inventors, Dept. 30-E, 631-E St., N. W., Washington 6, D.C.

WANTED Old cigarette cards. Write Charles Bray, East Bangor, Penna.

EXCHANGE Viewcards with members world over. 10c brings magazine with list members. World Viewcards, King, N. Car.

UNUSED matchbook covers—100 different $1.00—Catalog 25c—Charles Edelman 1311P East 84, Cleveland 3, Ohio.

43 POTTERY & CERAMICS

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44 ANTIQUES, RELICS, INDIAN GOODS

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46 MINERALS & PRECIOUS STONES

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GOLD ore sample with geological history—50c. Doug Morrell. Helena. Montana.

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48 PHOTO FINISHING

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FREE Mailers. Jumbo Prints 8 Exposure Roll 30c. 12—45c. 20—95c. Careful Work. Western Photo. Dept. S41, Box 298. San Francisco. Calif.

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50 PHOTOPRINTS, PHOTOCOPIES

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NOVELTY Stamp Photos made. Samples. Rush Postal. Heavener. Colmar, Penna.

51 MOTION PICTURES, SOUND EQUIPMENT

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BARGAINS. used 16mm Sound Projectors $100 up. We trade. sell. buy movie films. Mention Mm. Gallard. 29C Coe Ave.. Hillside. N. J.

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52 MUSIC, MUSICAL INSTRUMENTS

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53 SONG WRITERS

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55 TELEVISION

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63 HIGHGRADE SALESMEN

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80 PRINTING, MULTIGRAPHING, ETC.

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83 FOR INVENTORS

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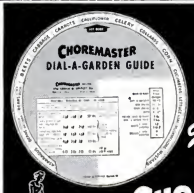

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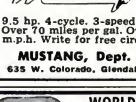

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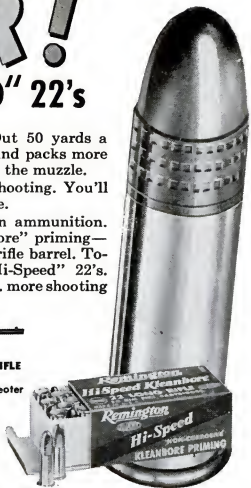

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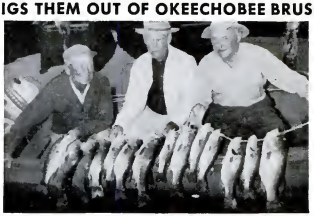

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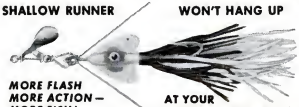

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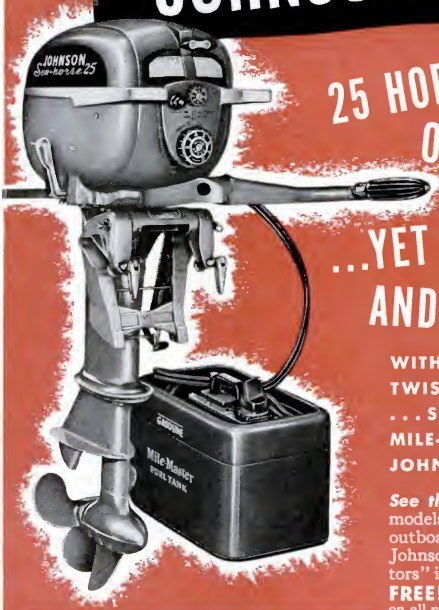

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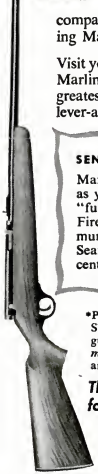

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Convert HAND MOWERS TO **POWER MOWERS**

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BECAUSE THEY ARE ALL ONE PIECE—

G-E "All-Glass" HEADLAMPS

DO NOT GROW DIM!

DIRT AND MOISTURE CAN'T GET IN TO REDUCE LIGHT OUTPUT

THE cutaway view above reveals one big reason why General Electric "All-Glass" headlamps do not grow dim. Lens and reflector are *one piece,* with filaments firmly anchored in the reflector, making the whole lamp one unit. Because it's a single unit, dirt and moisture can't get in to dull the reflector.

"All-Glass" headlamps give more light, right from the start. And they continue to give more. Tests show they average 99% as much light at end of lamp life as when new. New or old, G-E "All-Glass" headlamps help make your night driving safer and more comfortable.

Get ready for Summer driving by checking your lamps now. And be sure to ask for General Electric headlamps by name if you need a replacement.

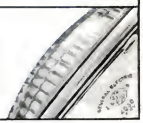
HERE'S HOW TO PLAY SAFE WHEN YOU BUY SEALED-BEAMS

1. FEEL THE SEAL

There is no seam where glass reflector and glass lens are fused into one piece. Dirt and moisture can't get in.

2. SEE THE G-E

It's on the back of the headlamp near the top. It's your assurance that your headlamps WILL NOT GROW DIM.



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Every mile is money saved, every moment a thrill . . . when you ride this swift, smooth "streamliner"! It takes you comfortably to daily work or distant points . . . at amazingly low cost. It brings you endless good times at race-meets, tours and other exciting motorcycling fun events. With it you can play a vital part in your local defense program. Easy terms. See your dealer. Mail coupon.

Send me free copy of ENTHUSIAST Magazine filled with motorcycle action pictures and stories; also literature on new models.

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DEALERS: Valuable franchises available for the full line of famous Big Twins and the 125 Model. Write today.

Music's immortals play again, sing again, in RCA Victor's "Treasury of Immortal Performances"

A treasury of ***Music's Immortals***

Now artists whose names are musical legend live again for the modern listener. You can hear them, at their finest, in RCA Victor's "Treasury of Immortal Performances."

In recreating these performances on both 33 and 45 rpm, acoustical engineers drew on a vault of master records guarded for posterity by RCA Victor. But new electronic techniques, developed through RCA research, give the new records a richness and quality of sound far surpassing that of the originals.

Because RCA Victor could draw on so vast a storehouse, there is something in the "Treasury of Immortal Performances" for every listener. Caruso sings light and serious music—as do Schumann-Heink, Mary Garden, and others . . . Paderewski is here . . . and, if your taste is for popular music, such greats as Berigan, Armstrong, Waller, in rare early records.

* * *

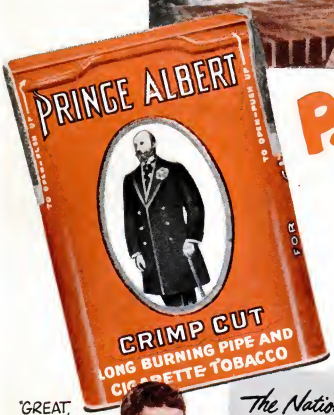
See the latest wonders of radio, television, and electronics at RCA Exhibition Hall, 36 West 49th St., N. Y. Admission is free. Radio Corporation of America, Radio City, New York 20, N. Y.

The magic of RCA Victor's "45" system—as an independent unit, or combined with radio or television—has led 55 record-makers to adopt it.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

You're always welcome when you've got P.A.



P.A. means Pipe Appeal and Prince Albert

You get a big welcome when you smoke a pipe. And your tongue will welcome the cool mildness of crimp cut Prince Albert—America's largest-selling smoking tobacco. Try flavorful P.A.—choice tobacco, specially treated to insure against tongue bite.

The National Joy Smoke

R. J. Reynolds Tobacco Co.
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Popular Science *Highlights* This Month

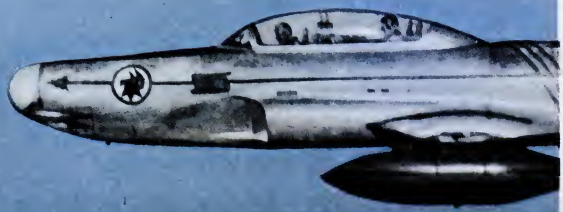
What's Behind Sunglasses: Here's the inside story on those colored glasses—how 8,000,000 pairs a year are made at prices from 25 cents up. **Page 141**

Garden Furniture Beat-Up? Weather and hard use take their toll of lawn chairs. But simple repair dodges make them like new again. **Page 177**

It Steers by Touch: "Nearest thing to an automatic pilot," says Wilbur Shaw of the power steering on the souped-up Chrysler. **Page 126**

Trouble Brewing in Your Car Radiator? Rust, hard water, and electrolytic action attack cooling systems. Here's what you can do. **Page 198**

Glamor Fences: A big reason for the appeal of Southern California homes is their attractive fences. These five fit any yard. **Page 186**



"I Flew With Our Jet Defenders"

Radar-eyed fighters, on 24-hour duty, defy weather to seek out unidentified planes and guard the U. S. against sneak bomb attacks.

Capt. Lee R. Ziegelgruber, one of 52nd's ace pilots, tightens straps on Francis' parachute harness. Francis reported that Man-from-Mars outfit felt too much like a strait jacket.

By Devon Francis

PS PHOTOS BY W. W. MORRIS

McGuire Air Force Base, New Jersey

TOM PAWLOWSKI is a young man with a brush cut who sits around playing gin rummy and poker a good many hours each week—attired in flying suit and Mae West life preserver.

He plays cards to while the time away. He wears the flying suit and Mae West because one minute he may be trying to fill an outside straight with deuces wild, and the next he may be legging it toward a multi-gunned jet fighter plane for take-off.

This photograph of one of 52nd Wing's F-94 all-weather fighters, with Maj. Joseph A. Barrett, squadron commander, at the controls, was taken by POPULAR SCIENCE Associate Editor Devon Francis from rear cockpit of a T-33 jet trainer. Pointed cylinder in foreground is a wing-tip auxiliary fuel tank like that on fighter.

I met Tom Pawlowski in a converted Army trailer parked at the downwind end of the "working" runway. I had come to make a jet flight. He looked up as I came through the door, and returned to his cards. Visitors had been no novelty since the McGuire base had gone on a 24-hour air-defense alert at the start of the Korean war.

All that interested Pawlowski and seven other men in the trailer—another pilot, two radarmen, and four mechanics—was a telephone. It sat within arm's reach. When it rang, they "scrambled," regardless of the weather. A scramble was a take-off as fast as a pilot and a radarman could race to a Lockheed F-94 fighter plane parked 100 feet away, climb in, and start the engine.

This was no military exercise in make-believe. So far as these men—members of the 52nd Fighter All-Weather Wing—were concerned, it was war, conducted over the terrain of a nation as yet unpocked by bombs. It was the business of the Air Force to anticipate the possibility of air attacks on major U. S. cities.

Orders for a scramble meant that ground-warning radar had picked up the scent of an unidentified airplane. An F-94 radar-equipped fighter, with guns loaded, might be ordered to streak due east at 2,000 feet to intercept the unknown plane. Or it might be ordered northeast at 20,000 feet or

Rapidly-revolving radar antennas such as these provide both early warning for U.S. air defense and air-traffic information for ground control. Radar network is still inadequate.

Telephone wires, continuously open, carry warnings of unidentified aircraft to Combat Alert Centers like this one at McGuire AFB. Alert Centers initiate pilot "scrambles."

At telephoned alarm, pilots race from trailer toward planes, followed by radarmen and ground crews. Trailer was rebuilt, completely outfitted at McGuire to speed pilots into air.

Ground crewmen button pilot, radar operator into their cockpits for take-off. Vent at side of fuselage is air inlet for turbine engine. From alarm to take-off is only a matter of minutes.

higher—in weather so foul that all air liners were grounded.

It didn't matter that most of the hundreds of aircraft they had intercepted and identified in these last few months had been air liners ahead of, or behind, schedule. When that phone rang, they were on their feet.

You don't get acquainted easily with fighter pilots on alert duty. They are taut. The waiting, hour after hour, does that. They answer questions to the point, briefly. Captain Pawlowski was, like his fellow fliers, chosen with special care for the job. Any man with intelligence and a knack for flying can be a jet jockey. But it takes experience and judgment to be an all-weather pilot. He can't get panicky when the telephone rings and visibility is so bad that he can hardly distinguish his plane outside.

I had come down by special consent of the Air Force to take part in a simulated scramble. Denied to me—with good reason—was a flight in the radar-eyed F-94. I'm not a military pilot or radarman, and there are no seats for passengers. However, they would let me sample the routine in a T-33. That's the Lockheed Shooting Star jet—the F-80—modified as a two-cockpit job. An F-94 would meet us upstairs.

Captain Pawlowski was from Succasunna,

Pilots, radar operators, and ground crewmen on duty occupy this air-conditioned trailer at downwind end of "working" runway. Bunks are for cat naps. Hot coffee is always ready.

Power cart like this one stands at rear of each jet fighter to start plane engine. It carries a fire extinguisher for emergencies. Cone in foreground is end of wing-tip tank.

N. J. He was 28, married, and the father of a daughter, almost four. During the war he had flown B-26's (60 missions) with the Twelfth Air Force in the Mediterranean. After the war, in Japan, he had flown F-61 night fighters.

What was the F-94 like?

Pawlowski rubbed his chin. "It's a simple airplane," he replied. "I'll tell you how simple it is—when you take off, you keep thinking that you've forgotten something."

There was other flier talk. Of course, I remarked, if a man had a flame-out—if his engine stopped—he would have precious little chance of making a successful landing. The F-94's wings were too short, thin, and narrow to afford much lift without power.

The two pilots and two radarmen grinned.

"I know of one guy," said Pawlowski, "who was flying at 35,000 feet going south over the Florida keys. His fire went out. He turned around and glided 80 miles back to Boca Chica, and then had to wash off 9,000 feet more before he could land."

In discussing their jobs they were more diffident. They gave sketchy details:

When the telephone rang, the message was brief: "Heading zero eight five at 18,000." That's all brother! Scramble! The wing's Combat Alert Center has done its job. The rest is up to the men in the flying suits and Mae Wests.

Time is gold. Bombers fly fast these days. An alert by early-warning radar at 150 miles would allow only 30 minutes to intercept a 300-mile-an-hour bomber.

Radarman Navigates Ship

The take-off may be into a sky as black as the inside of a cat. The pilot does the flying. His radarman in the seat behind does all the navigating. The pilot "retires to the library," checking pitch, bank, and direction by gyro horizon, rate-of-climb indicator, needle-and-ball and directional gyro. His eyes periodically sweep his engine instruments—his tach, tail-pipe temperature gauge, oil pressure and oil supply.

The radarman studies his oscilloscope. Air Defense Direction Centers, monitoring the unidentified aircraft by ground radar, vector the fighter toward the target.

"We have contact," the F-94 radarman presently will advise the ADDC in code.

The pip on his scope is unmistakable.

"Target 5° port, 3,000 yards, 10° above," chants the radarman on the interphone.

Up front, the pilot takes over. He has switched on his own scope and is getting an identical reading.

"I've got it," he calls back.

If it's an enemy, the pilot will center his pip, close to a distance indicated on a range meter, and fire. There's no need to see the target in the F-94.

One basic assumption of the Air Force is that an enemy may wait for bad weather to send his bombers. Also, since the nights are now shorter, the danger of attack grows greater. An enemy can launch bombers against us with less chance of successful retaliation. Our bombers would have fewer hours of darkness to protect them against

interception as they tried to penetrate the enemy's vast land mass to strike at his cities.

Captain Pawlowski, sitting in his flying suit and Mae West, was reaching for a cup of coffee when the phone rang.

Eight men were on their feet as one. Receipt of the message must have taken five seconds. Then they scrambled. I'd never seen eight men get through one door so fast.

Captain Pawlowski and a brother pilot raced to the two parked F-94's.

One sergeant crew chief shot the juice from a power cart into the plane to turn over the jet engine of one fighter. The other crew chief waited, tense as the men in the cockpits, by the second plane. If the engine of the first plane didn't catch, he would pour juice into the second one.

It did catch, and in seconds the plane was gathering speed on the runway, leaving the bellow of a 100 angry bulls behind.

In a moment it would be my turn.

At the downwind end of the runway Major Joseph A. Barrett, commanding officer of the 52nd's Second Fighter Squadron, was turning into the wind for his take-off. My pilot and I would rendezvous with him.

Major Barrett's fighter slowly gathered speed on a hazy field. He was quickly swallowed up by poor visibility.

At the Combat Alert Center I was fitted out with a flying suit and a Mae West. Captain Lee R. Ziegelgruber, of Brimson, Mo., a bomber pilot in the Southwest Pacific during the war and winner of the Distinguished Flying Cross, took me in tow.

We slid into the fuselage of our ship. The canopy was lowered. We were snugged in. Even through the padding of my earphones and helmet I could hear the muttering of the gases at the tailpipe.

"Ziggy to the tower," said my pilot.

He got his clearance for take-off.

At the runway we turned into the wind.

"Okay?" asked Ziggy.

I pressed the button on top of the throttle ball at my left hand to reply. "Okay," I said.

The throttle went full forward. We gathered speed. The gases roared. There was no vibration except from irregularities on the runway. Of a sudden, we were airborne. For a few seconds the nose was held almost level. Then it came up sharply, and we were climbing fast.

I felt pressed down in my seat. That was Gs imposed by our rate of climb.

My pilot called Barrett by radio.

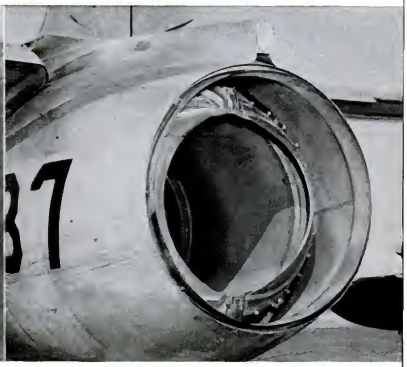
Barrett replied, "I'm at 43,000 and coming down." That was seven miles above us. "Hurry, I'm about out of fuel."

We were hurrying. I could tell that by the way the altimeter needles were spinning.

"At 10,000," Ziegelgruber reported to Barrett.

I looked over the side. In the haze the air base had lost all definition.

Wing-tip tanks are painted black on planeward side to prevent reflections of hot exhaust gases to fliers' eyes. All U.S. air-defense wings will eventually get all-weather planes.



Tailpipes of jets contain "eyelids" to vary aperture through which gases must go. Eyelids are opened when afterburner pours added fuel into pipe for bursts of extra speed.

The captain called me on the interphone. "He's behind us," he remarked.

As in any airplane, there was no sense of speed. Only the air-speed indicator, registering hundreds of knots, told me that we were flying far faster than the fastest commercial transport. From the bowels of the plane came the muffled thunder of power. The little pale-green oxygen indicator on the instrument panel winked at me slowly.

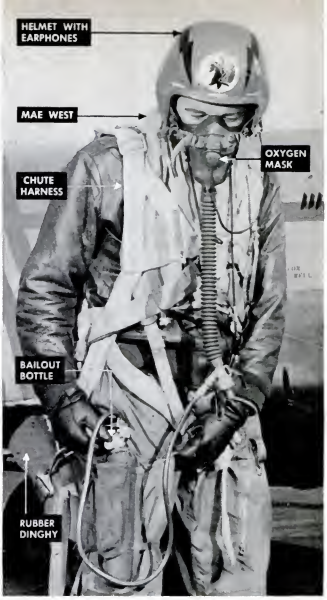
Off our right wing Major Barrett came inching up on us.

Barrett had had 18 months in the Aleutians, where it's a good day when the fog lifts for an hour. He had learned his bad-weather flying the hard way.

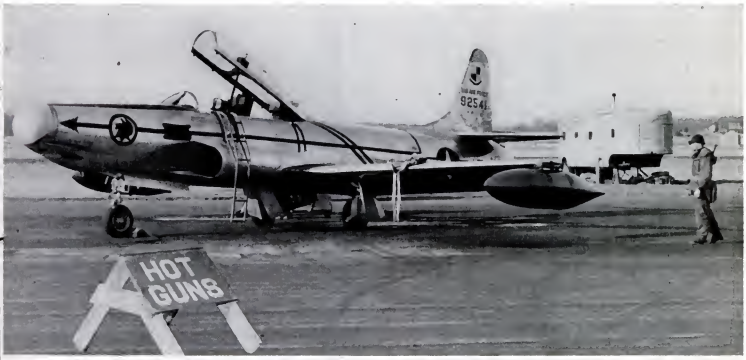
Now he waved farewell. The rendezvous was over. He banked and seemed to evaporate, so fast was the separation rate of the two planes at the speeds we were going.

Captain Ziegelgruber glided down. The air roughened. The chop thumped at the plane. We swept over the lip of the runway on an overhead approach, banked smartly, circled, and coasted in. My pilot greased it on. Vibration told us that the wings were transferring their load to the wheels. Gradually our speed slackened.

In the distance, at the downwind end of the working runway, four tiny figures in flying suits and yellow Mae Wests were running toward a brace of F-94's. That phone must have rung again. END



Tom Pawlowski, whose picture appears on cover of this issue of POPULAR SCIENCE, checks his bailout oxygen bottle before starting flight. Even off duty, crews remain on instant's call.



Signs posted by alerted planes warn that guns are loaded. As yet, USAF does not have enough all-weather fighter groups for proper defense, but new radar-eyed planes are in production. One type will be Northrop F-89, faster than F-94. All air defense by plane is under direction of Air Defense Command, headed by Lt. Gen. Ennis C. Whitehead, at Colorado Springs.

Front tire lets go on the Speedway as Wilbur Shaw tests how safe new "blowout-safe" tire really is.

"Tire-in-a-Tire" Gives Safety Against Blowouts

WILBUR SHAW wheeled a Buick convertible around the Indianapolis Speedway at 80 miles an hour recently. A front tire blew out. Yet the famous writer of the PS "Report from the Driver's Seat" drove another mile, never losing control. When he stopped, the tire still held two-thirds of its original air pressure.

That tire was one of Firestone's new blowout-safe, puncture-proof, tubeless models. Blowout-resisting *tubes* have been on the market a long time, and two years ago Goodrich introduced a tubeless *tire* (PS Apr. '49, p. 118) with a puncture-proof lining that also helps hold air some time after a blowout. Now Firestone has gone a step farther by making a tubeless tire with a puncture-proof lining *and* an extra blowout-protecting diaphragm. Actually, it's almost two tires in one. Outside you see what looks like an ordinary tire. But inside is a tough diaphragm—the "second tire."

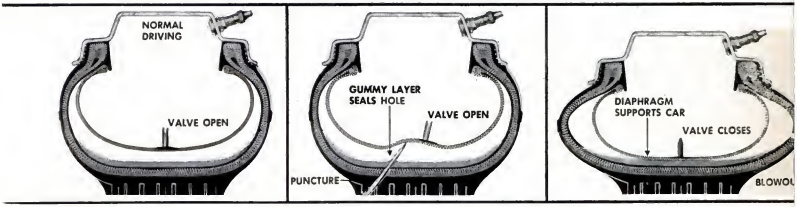
Ordinarily, this diaphragm is free of the outer tire except at the edges, where it is attached to the tire bead. This provides two spaces for air—one between the wheel rim and the diaphragm, the other between the diaphragm and the outer tire. A valve in the diaphragm lets air flow freely back and forth through the diaphragm, equalizing air pressure in the two spaces. The tire can be inflated like an ordinary tire, and it rides like an ordinary tire.

If the casing blows out, the air escapes from the space between the diaphragm and the outer tire. The wheel drops slightly, so that the car weight now rests on the diaphragm. The automatic valve closes, sealing in the air between the diaphragm and the wheel rim. Thus, even after a blowout, most of the air remains inside the tire.

The new tire is also puncture-proof. Soft, sticky rubber inside it plugs up holes caused by nails or other sharp objects. This rubber clings to nails as they enter, preventing any loss of air. And removing the nail just pulls the pliable rubber back to fill the hole.

The new tire is built up of three specially compounded types of rubber, and uses cord in the body made of nylon and rayon. It fits all modern cars, and can be retreaded in the same way as other tires.

Wilbur Shaw, racing driver well known to PS readers for his "Report from the Driver's Seat," checks tire pressure before starting his blowout test run (left, above). The casing was purposely damaged so it would fail—and it did when Shaw was clocking 80. After riding a mile on the blown tire, another check (right) shows over two-thirds of pressure remaining.



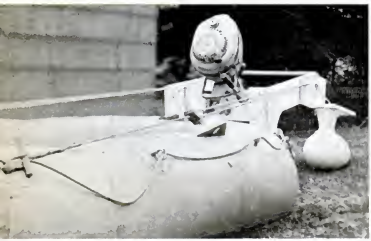
New tire is shown under various driving conditions in drawings above. At left, it is riding normally and diaphragm valve is open to keep air pressure equalized. Center, nail puncture is sealed by soft rubber lining without loss of air. Right, blowout lets some air escape, but rush of air closes diaphragm valve, sealing bulk of air inside diaphragm, which supports car.

The new tube, shown below, first puncture-proof type to be made entirely of butyl, is also being introduced by Firestone. No air escapes even when nail is driven through, as demonstrated below at left. Drawing (right) shows why: inner layer of soft butyl flows around nail to stop air loss. New tube will cost 25 percent less than similar ones now on market.

Motor that might tip tiny raft if attached to its end is floated behind it on this homemade rig.

Floating Motor Powers Rubber Boat

Built of war-surplus parts, this "trailer in reverse" uses a float-mounted outboard in back.



Steering mechanism is simple. Moving wooden block along clothesline shifts position of float. Block locks in position when released.

ROBERT ZASTROW, of Seattle, Wash., had trouble attaching a 3½-hp. outboard motor to the edge of his tiny rubber liferaft, so he simply built a floating mount for the motor and hitched it on behind. Now he has a lightweight, portable motorboat that's perfect for fishing trips, and the whole rig, except for the motor, cost him only $40.

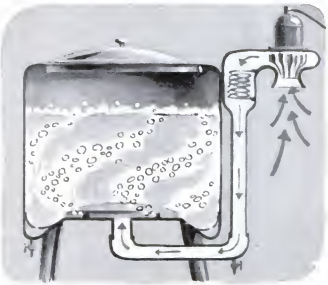
To float the motor, Zastrow built a wood platform across two surplus aircraft antenna housings, cocked slightly backward to keep them from nose-diving. A trailer-like pivot hitch lets the motor mount turn, and ropes running from the mount to the front of the raft steer the rig.

Entire rear unit, rather than motor alone, is turned for steering. Zastrow used 5-ply veneer and two-by-four stock. Bracing is important.

A ½-inch galvanized pipe and flange are screwed to thrust block inside rubber flap on lifeboat. Flange acts as bearing for float.

New Ideas from the Inventors

1 Car Body to Open Up. Designed to be inexpensively produced, this proposed automobile has no doors. Instead, the body, consisting of two shell-like sections, opens up to admit the passengers. The car wheels are arranged in the shape of a diamond and steering is accomplished with the single front and rear wheels. Two seats, one facing forward and the other to the rear, are mounted over the car's engine.

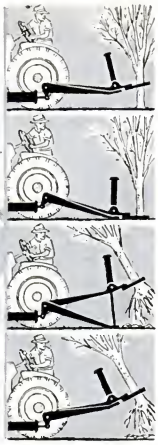


2 Clothes Washer to Use Hot Air. Hot air agitates the clothes in this washing machine. Air drawn in by an electric suction fan passes through an electric heater and then is forced under pressure up through the clothes and soapy water. After rinsing and draining are completed, the washer can use hot air to dry the clothes.

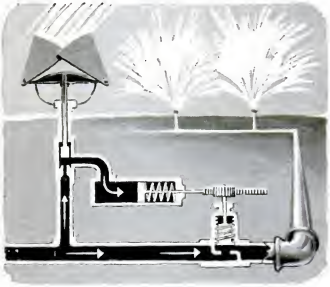
3 Radiation Alarm to Fit Pocket. An atom-plant worker carrying one of these alarms in his pocket would be warned by a buzzing noise if the radiation in his vicinity got beyond safe limits (see PS, Mar. '51, p. 280). When exposed to unsafe radiation, a tiny ionization chamber within the device passes current and sounds buzzer.

Turn the page, please, for three more new ideas.

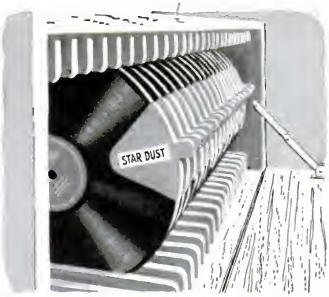
MORE New Ideas from the Inventors



4 Tractor Tree Puller. Mounted on the rear of a tractor, this tree, stump, and brush puller requires a minimum of power because it lifts the tree vertically out of the ground. Operated hydraulically, the jaws of the puller are first positioned around the tree, then lowered and clamped around the tree at its base. Next a jack is operated to force the jaws up and away from the ground, pulling the tree loose.



5 Sun to Operate Lawn Sprinkler. The sun would take care of timing the sprinkling of your lawn if you had this device. It consists of a sun-operated thermostat connected to the sprinkler valve. By adjusting masks that shield the thermostat it can be set to turn the sprinklers on and off at any desired sun positions.



6 Tabs to Identify Records. The chore of hunting for a particular record in a collection would be simplified with these tabs. Made of thin metal and provided with a space for the record title, they slip on or off the records easily so only the tab, not the record, need be removed to learn the title of the record.

Patents on these inventions have been granted to: 1. M. Alamagny, St. Cloud, France; 2. M. Cole, Manchester, Tenn.; 3. R. Brown, Lawndale, Calif., and H. Weiss, Waltham, Mass.; 4. T. Slick, San Antonio, Tex.; 5. R. Higgins, San Francisco, Calif.; 6. E. Brownsey, La Porte, Ind.

Passengers sit only few inches above road in Britain's tiny new midget, the R.N.W. (left), which has 16-inch wheels. The vertical slot in the rear fender is air intake for engine.

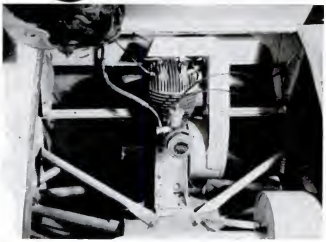
Small size of car is emphasized by woman standing alongside (right)—and she is of average height. Yet the car seats two.

Tiny British Car Seats Two, Goes 50

THIS British midget is so small it doesn't even need a garage—it would fit easily in most garden-tool sheds. It's only a little more than four feet high and eight feet long, with a width less than five feet.

Yet it seats two comfortably, and can reach 50 m.p.h. It has an integral body and chassis of steel alloy, with a box frame. A convertible, it has sliding plastic windows in the doors, and a deep windshield for good visibility. Styling is conventional, but there's nothing under the hood except leg room, luggage space, and a spare tire.

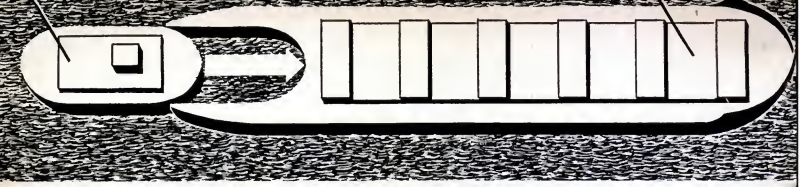
Called the R.N.W. (after designer Roy N. Wellington, of Surrey), it is expected to cost about half as much as current British small cars. Production is scheduled for June.



Engine is lost inside rear deck (above). A single-cylinder, two-cycle Villiers of 12-cubic-inch capacity, it runs on gas-oil mixture. Transmission has three speeds forward, one reverse.

British Army Truck Likes Rough Going

BRITAIN'S Tommies are getting a new vehicle, too. It's a one-ton combat cargo carrier (right) designed for good cross-country performance. In addition to fully independent suspension on all four wheels, it has double-acting shock absorbers and secondary suspension. The six-cylinder engine drives it through a five-speed transmission.



The propelling tug rides with four-fifths of its length inside the barge that it pushes.

Tugboat Gets Inside Barge to Push It

WHAT appears in the photo below as a single ship is really a tugboat virtually surrounded by a barge. The 64-foot, 99-ton tug fits into the sliplike opening at the stern of the barge, as shown in the diagram. The units lock together and act as a single integrated hull, even in rough waters.

The unique arrangement eliminates awkward and tricky towlines. It is said to permit safe operation of river-type barges on the Great Lakes or the open sea for the first time. While one barge is loading or unloading, the tug can be quickly detached and used to power another one.

The tug, called the *Carport*, is powered by a Fairbanks-Morse 8-cylinder Diesel engine of 1,280 hp. Low river bridges are no problem, as the pilot house can be raised and lowered hydraulically.

The all-steel welded barge, outfitted to haul both bulk materials and liquid cargo, is 287 feet long and 43 feet wide, and has a capacity of 2,000 tons.

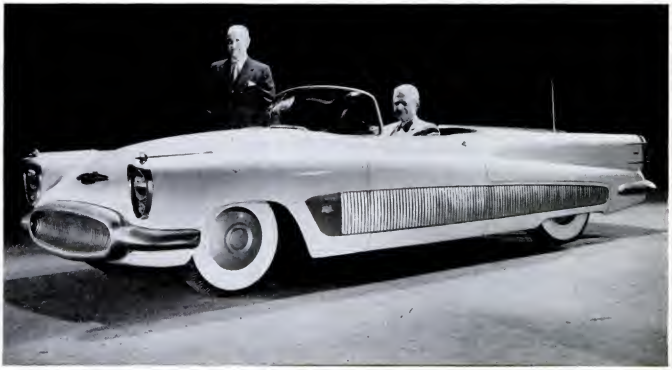
Cargo Carriers, Inc., of Cleveland, will run the vessel on the Great Lakes, the N. Y. State Barge Canal, and between New York and San Francisco via the Panama Canal. On its first trial run, it averaged 14 m.p.h.

Joined together, tug and barge below look like a single craft. Photo at the left, taken from the deck of the uncoupled barge, shows matching bow of the tug. When linked, the two parts of craft are locked with giant turnbuckles.

From rear, barge looks like huge whaling vessel. Opening is shaped to match contours of tug.

Buick Builds a 150-m.p.h. Experimental Car

STRICTLY a one-of-its-kind, the car below was built for experimental purposes. The aluminum body has louvers from front fender through rear-wheel housing. It has crash-type instrument panel, safety belts, and special tires for high-speed driving. Like an experimental GM brother, (PS, Feb. '51, p. 130), it has a 300-hp. engine.



Army Now Has World's Largest Intercom

A field commander can now ring up a front-line foxhole—or the White House—as easily as you make a long-distance telephone call.

By Martin Mann

DRAWING BY DENVER GILLEN

How voice of distant GI could be carried directly to White House, jumping from wire to radio to cable, is shown in drawing. Integration of whole Army into one unified communication system will make this possible—and, more important, greatly simplify control of battlefield action.

THE Commander-in-Chief can soon pick up a telephone in Washington and talk directly to a soldier in a front-line foxhole. The Army's new communications system will be, in effect, a vast intercom setup in which all the Army will be able to talk to all the rest of the Army.

Fighting doughfoots aren't likely to put in a call for the White House, although they might like to. But they do have to talk to tankers and artillerymen in their business. And this has not been easy up to now.

Even in Korea infantrymen sometimes had to signal tankers by banging rocks on the outside of the tank. Or they might have been lucky enough to find a telephone strapped like a bustle to the tank's rear.

Sure tanks have radios. And so does the infantry. But tank radios now in use can talk only to other tank radios. They can't receive, or be received by, infantry radios.

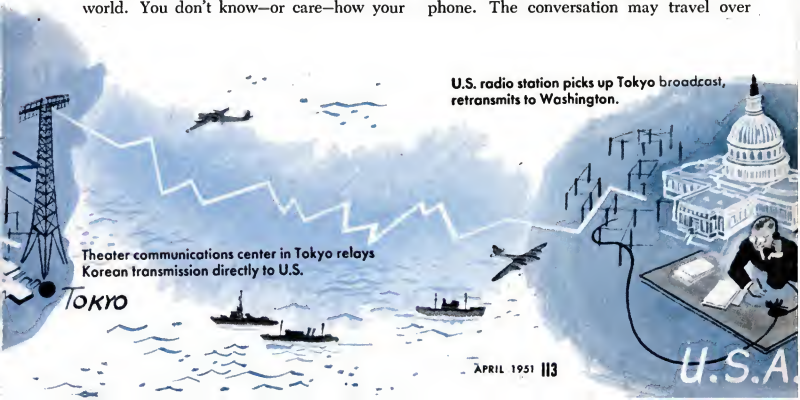
This lack of interconnection has added to communication snafus. The little *handie*-talkies, for example, are AM sets. But the *walkie*-talkies used by the same outfits are FM. They don't speak the same language.

Postwar Aim an Integrated System

World War II showed how hard it was to fight intelligently when we had radios that worked all right within their own small "nets," but didn't tie in with nearby nets. So Signal Corps engineers started the postwar job of designing an integrated communication system for the whole Army. They set out to give the combat soldier the same kind of tightly knit communications network that civilians have. You expect to be able to pick up the nearest phone and talk to any other phone anywhere else in the world. You don't know—or care—how your voice gets there, whether it travels on wire lines, radio waves, coaxial cable, or all three.

Tall smokestack provides ready-made antenna mast during Korean fighting. Ingenuity at making best use of available structures and terrain helps get most out of Signal Corps equipment.

With the new Signal Corps equipment, soldiers will get the same service. A captain at the front who wants to report to regimental headquarters can pick up his telephone. The conversation may travel over



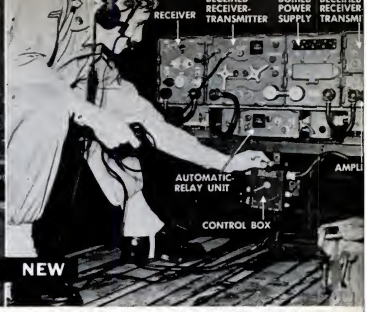
Cable repair is easier from this homemade platform-on-a-truck, developed by Sgt. Byron G. Anderson of Signal Corps unit in Korea. Army uses civilian phone lines whenever possible.

Loop antenna (above) plugs into new handie-talkie, converting it into radio direction finder. This is big help in reassembling scattered units—GIs just "home" on signal from commander's set.

wire, if there is a line, or be broadcast over radio. If necessary, the connection could be extended all the way to the Pentagon.

Perhaps more important, it's just as easy to connect the captain to nearby tank or artillery units. All would have different radios, but each set would overlap the frequency

WALKIE-TALKIE. New model has four times as many channels as World War II version (shown in use at left to spot artillery fire in Korea), yet is only half as big and half as heavy. It covers five miles with 10-foot antenna. And it *can* talk to the new handie-talkies. Three models, one each for infantry, armor, and artillery, have different channel frequencies, but all three have a few identical channels so that they can intercommunicate easily.



OLD NEW

RADIO. Building-block radios will replace number of old sets like one at left. The "blocks" are several types of receivers, transmitters, receiver-transmitters, power supplies, control units, and amplifiers that can be combined in many different ways. Plug-in wires interconnect the various blocks. A setup that might be issued to battalion (such as one at right) will be able to listen in on its companies' network, while at same time transmitting to regimental headquarters. By turning a switch, operator can also make it work as a relay point, picking up a conversation from one station and simultaneously retransmitting it to another. With old sets, operator had to copy down message, then rebroadcast it himself. Remote control is also possible. The radios can be installed on high ground to increase their range, while operator sits in a protected location, safe from enemy fire. Sets can be connected to new phone switchboards.

ranges of the others, making intercommunication simple.

There's a new *handie-talkie,* smaller than the World War II version; a new *walkie-talkie,* half the size and weight of the old job; and a whole series of *radio "building blocks,"*—10 plug-in units that can be combined in various ways to make 30 different radio combinations.

These building-block radios are a completely new development, using a few standardized units to handle all sorts of jobs. Stacking together a few units—the way a child does building blocks—makes a station

HANDIE-TALKIE. New model looks much like old one (shown at left being used in Philippines during World War II), but uses FM circuit to agree with other combat radios and covers about a mile with quarter-watt output. It can operate on any one of 43 very-high-frequency channels, but channel cannot ordinarily be changed in the field. By plugging in small, extra handset, soldier can talk while 6½-pound radio is slung over his shoulder.

New telephone wire, already used in Korea, is lighter and more efficient than the old stuff. It uses no rubber at all—insulation is polyethylene plastic covered with nylon. And it can be laid from a truck, jeep (as shown in photo above from Korea), plane, helicopter, man-carried pack (the half-mile reel being carried by soldier at left weighs 26 pounds), or even shot across streams and gullies by a rifle grenade or bazooka shell. Talking range is about 12½ miles.

for a battalion. Adding some more units makes a station for, say, a division.

One block provides remote control: the radios can be installed on high ground to increase their range, while the operator sits in a healthier location, safe from enemy fire. Other blocks can be set up as an automatic relay to bridge a long gap between units. These will work all by themselves, without any operator.

Relays proved their worth in the early days of the Korean War, when thinly spread troops were often so far apart they outranged their radios. Until now, however,

TELETYPE. Teletypewriters provide one of fastest and most accurate ways of sending messages. But old equipment (shown in use in Korea at left) is so heavy—it takes four men to carry one station—that it is used only by large, settled units. One of new machines (right) weighs only 45 pounds, light enough to be dropped with a paratrooper, and is expected to see front-line use. It has 300 fewer parts than old machine, yet works two-thirds faster.

there has been no relay equipment designed for small units, the old radio relays being intended mainly for large groups like corps and armies.

All combat radios now use FM. There are a couple of reasons for this choice, besides uniformity. Very-high-frequency FM gives good quality, staticfree transmission. Its short range is a help rather than a hindrance when so many radios must operate in a small area. And there's also a "take-over feature," which prevents interference. When two AM transmitters interfere, both can be heard, but neither understood. But when two FM transmitters interfere, the more powerful one takes over, completely drowning out the weaker station.

Brass Always Gets Through

This works out fine for the Army, which assigns radio power according to the rank of the commander using it. Thus, all the captains are shut up while the colonel's radio speaks, and the colonel can be heard.

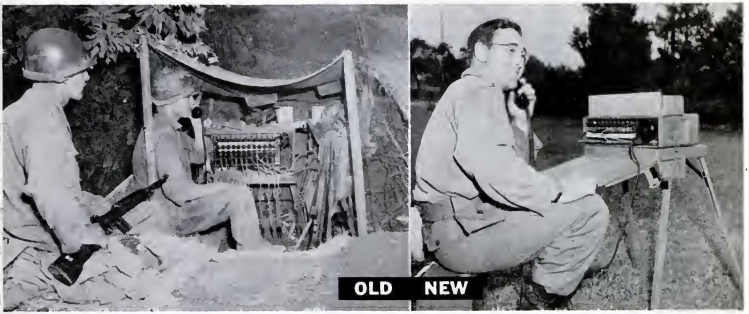
Intercommunication among Army, Air Force, and Navy is still a matter of individual arrangement and is not automatically provided by the basic communications equipment. Army radios can't ordinarily talk to Air Force or Navy radios. That's the way the services want it. They feel any advantage of easy intercommunication would be outweighed by the resulting confusion. Where intercommunication is most often needed—for air support of ground troops—the Army units are assigned liaison teams of Air Force personnel. These teams can relay ground commanders' requests to the strafing fighters.

New and better radios aren't all the Signal Corps has developed. Wire lines are still important. So are improved switchboards, which also use the building-block idea; lighter, more efficient telephone wire; and far lighter, faster, and simpler teletypewriters.

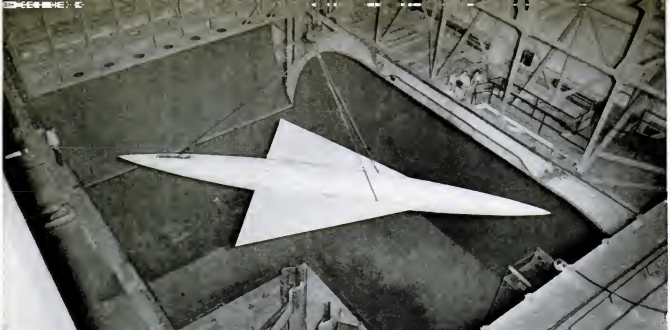
Television is under test, but the Signal Corps won't say what use it has in mind. Also being tried is a Dick Tracy radio the size of a cigarette pack—the day may yet come when every GI has his personal set.

This idea—everyone using his own radio—brings groans from the brass. As one colonel said, so many soldiers will be working radios there won't be anybody left to shoot! Even today a single armored division has 2,748 radios—almost eight times as many radios as tanks. The task of manufacturing so much electronic hardware, keeping it in repair, and training men to use it properly becomes fantastically complex. The new equipment helps lighten this job, since one unit may take the place of several old types.

Yet more and more communications equipment will be needed. For communications is control. It directs the shooting. Shooting wins the battles—but only if it's in the right place at the right time. That's the job communications, aided by the latest from the laboratories, must do. END

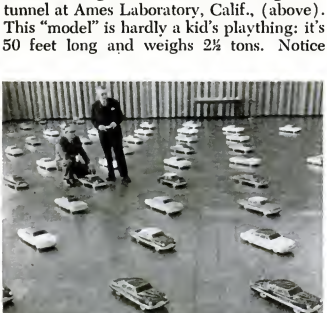


FIELD SWITCHBOARD. New types also use building-block idea. Blocks are connected quickly without soldering to make phone exchanges of almost any size. Smallest switchboard (right) is about as big as portable typewriter, yet handles 12 lines. Stacking several units expands it to take care of 63 lines. Larger blocks—for big units—can make a 2,000-line exchange in 24 hours. (It takes three months to build a civilian exchange of that size.)



Dart-Shape Fighter-Plane Model Gets Wind-Tunnel Test

HUGE doors open to admit another aeronautical designers' dream into the big wind tunnel at Ames Laboratory, Calif., (above). This "model" is hardly a kid's plaything: it's 50 feet long and weighs 2½ tons. Notice the comparative size of the man operating the hoist controls in the right background. The dart-like form—cigar-shaped fuselage and triangular wings—is expected to be a pattern for supersonic fighters of the future.



Car Models Preview Color Selection

THIS is how colors for the 1952 Ford cars are chosen. One-eighth-scale models, painted with actual production finishes, are carefully lined up on the floor of the styling showroom in Dearborn for study by company officials. Colors selected from this group are later tried on full-scale models for the final okay.

P S.: The models do *not* show 1952 body styles, just rough contours and colors.

Electric Curtain Warms Window Draft

"WE HAVE electric blankets; why not electric curtains?" So reasoned Jack Brightman, of Erie, Pa., who was annoyed with a cold draft from his living-room window. He looped some electric-blanket wire around the inside of the curtain, checked current draw for fire safety, and had Mrs. Brightman sew on the wire (above). Yes, he works for an electric-blanket manufacturer—GE—but as a refrigerator engineer.

You're on Your Own in This Garage

Old two-story brick building was remodeled to turn garage into self-service repair shop.

THE answer to the car owner who wants to tinker with the old buggy, but just doesn't have the space or necessary tools, is supplied by Carl Marten of Parkland, Washington.

A customer of this unusual self-service garage drives up to one of eight private work stalls containing a large workbench, a vise, and set of tools, and goes to work. He punches a time clock as he enters and again as he leaves. It's his responsibility to clean up and replace tools. As a double-check on tools, they are identified by number and color coding. The charge for use of the space is 50 cents an hour.

Service manuals are available for study and Marten is on hand for friendly advice when needed. If a job is too tough, a customer can hire the services of a trained mechanic. In the first month of operation, Marten grossed three times what he did with the conventional garage he used to run.

Even creepers are provided the customers. For help on the bigger jobs, you can hire the services of an expert mechanic by the hour.

Machine shop and general repair departments are equipped with $3,000 worth of equipment. Service manuals are on hand for reference.

Large work stalls give plenty of elbow room. Customer cleans up and replaces tools himself.

Ground and flight shots of B-47 show high flexibility of wing. It droops when plane is at rest on runway, straightens in normal flight. Plane's speed is rated at more than 600 m.p.h.

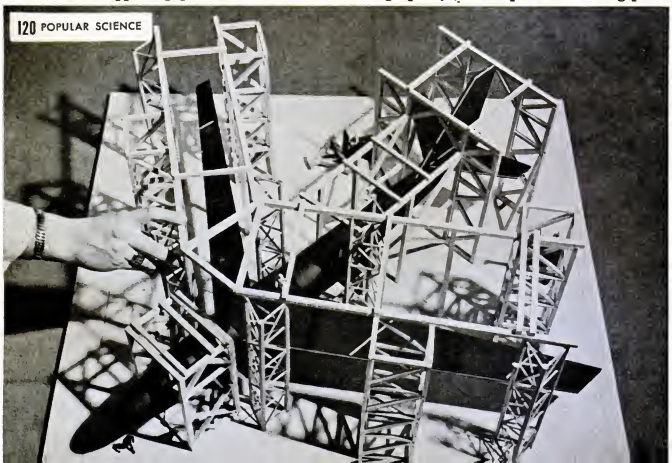
Torture Rack Tests World's Fastest Bomber

THEY have literally bent to pieces a B-47, the fastest known bomber in the world. They did it to find out how strong it was.

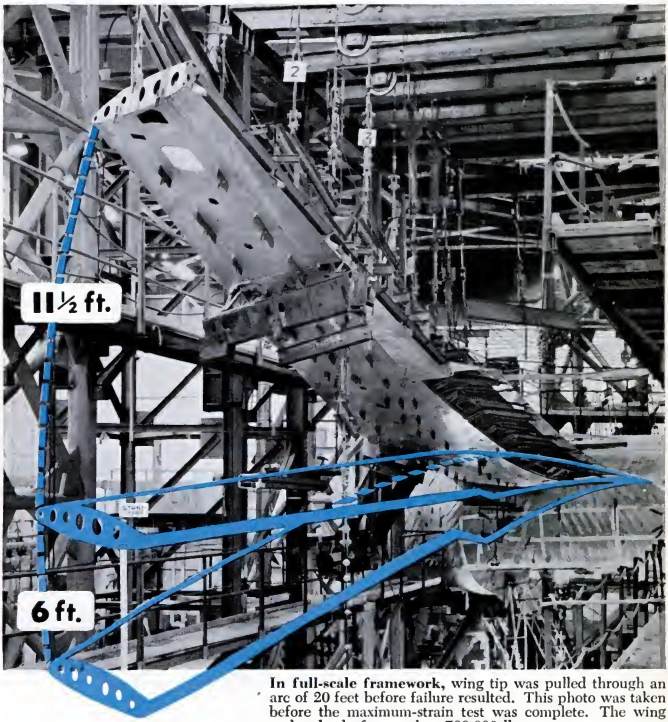
The Boeing Airplane Co.'s branch in Wichita, Kan., tested to destruction one of the planes, now being manufactured in quantity. The USAF wanted to know how much punishment the six-jet bombers would take if, for instance, they had to go into violent evasive action if attacked by an enemy during wartime missions.

The static testing was done within a huge metal framework supported by seven steel towers. The plane was supported by cables so that it "floated" in mid-air in an attitude of flight. Progressively, cables brought pressures to bear on wings, fuselage, and tail surfaces until the structure cracked. In all, 100 separate tests were made.

Model of torture rack shows framework to which cables supporting plane were attached. Hydraulic-exerted tension on cables, drawn through pulleys, tested parts to breaking point.



In flight, wing can flex several feet up and down to ride through downdrafts, updrafts. Wing, spanning 116 feet, has 35° sweep-back. Plane can carry a 10-ton bomb load.



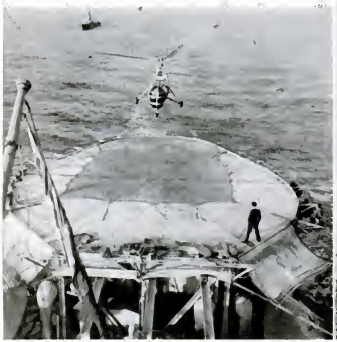
In full-scale framework, wing tip was pulled through an arc of 20 feet before failure resulted. This photo was taken before the maximum-strain test was complete. The wing took a load of more than 700,000 lb.

Tiny flight platform of test ship is smaller than alighting helicopter, whose blades of 50-foot span overhang its sides—but good landings are made even on rolling, pitching vessel.

Convoys May Fight Subs With 'Copters

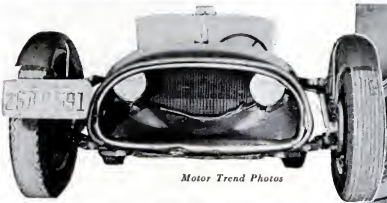
EQUIPPING merchant vessels with helicopters may help them, according to current British tests, to counter the submarine peril. Wartime convoys including one or more helicopter-carrying vessels might dispense with protection by escort-type aircraft carriers. Taking off from a tiny deck platform, a "flying windmill" would spot lurking subs, and attack them with depth charges and bombs.

For trials in the English Channel, the stern of the Royal Navy's 9,800-ton fleet supply ship *Fort Duquesne* has been fitted with an elevated steel platform, from which hundreds of successful flights have already been made.



Hovering helicopter is guided to safe landing, on nonskid mat of netting at center of flight platform, by controller standing at near edge. He uses two flags to signal to the pilot.

Type of 'copter used in trials is Royal Navy's standard S-51 Dragonfly, seen with crew aboard mother ship. This type or larger S-55 would carry depth charges and bombs in wartime.



Motor Trend Photos

For safer braking in changing road conditions, separate master cylinders (arrows) control circuits to front, rear wheels. Pressure ratios can be adjusted without stopping car.

Homemade Sports Car Can Race on Plowed Field

A SPORTS car home-built by Ted Cannon, North Hollywood, Calif., has hit a top speed of 105 m.p.h. with a reworked Mercury engine. The engine was bored and stroked to 270-cu.-in. displacement. It has milled heads and specially ground cams.

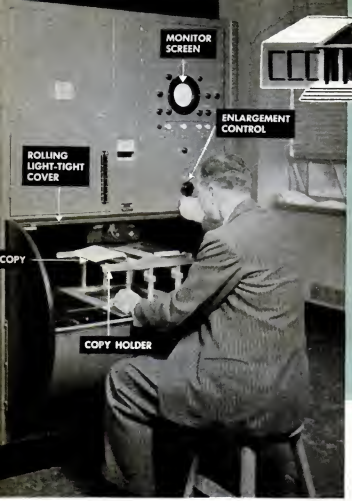
Excellent spring suspension enables Cannon to speed through a plowed field in second gear at 60 m.p.h. The front end has coil springs, the rear transverse leaves. The owner, head of an automotive engineering firm, built the car for road-racing against Jaguars and Allards.

It weighs 2,200 pounds.

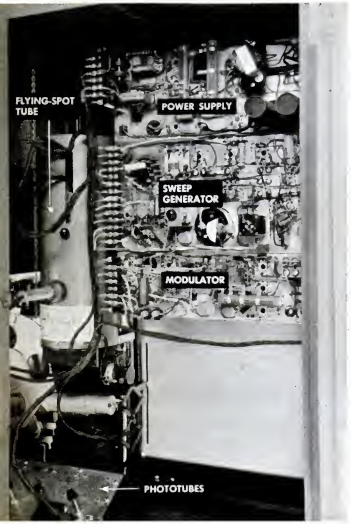
"Sapphire" Powder Makes Lab Crucibles

THE U.S. Air Force has succeeded in making laboratory crucibles which are extraordinarily strong and yet have a transparency rivaling that of English bone china.

Chemists of the Air Materiel Command used aluminum oxide powder for the crucibles. The only difference between them and sapphires is that the natural precious stones are single crystals of the oxide. The crucibles resist high temperatures.



TRANSMITTER uses "flying-spot" cathode-ray tube to project tiny beam of light that scans—moves rapidly across—the printed page. At same time, book is moved forward by electric motor. Phototubes, aimed at page, convert varying light values into electricity. Output is amplified, then sent over phone line to receiver.



LIBRARY

How Atomic Read Books

Facsimile system flashes library data to lab, to save time and avoid risk of making valuable books radioactive.

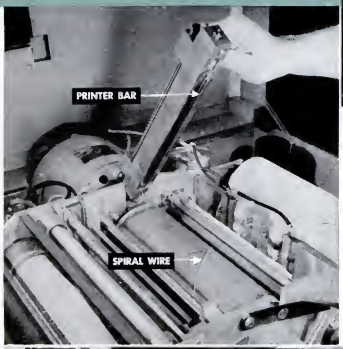
By Martin Mann

"SEND me the article on 'Proportional Counters,' in *Nucleonics* for November 1950, page 46," says the research chemist at the Oak Ridge atomic laboratory, speaking into an intercom. A few minutes later the article rolls into his hand, unwinding from a box that looks like a filing cabinet.

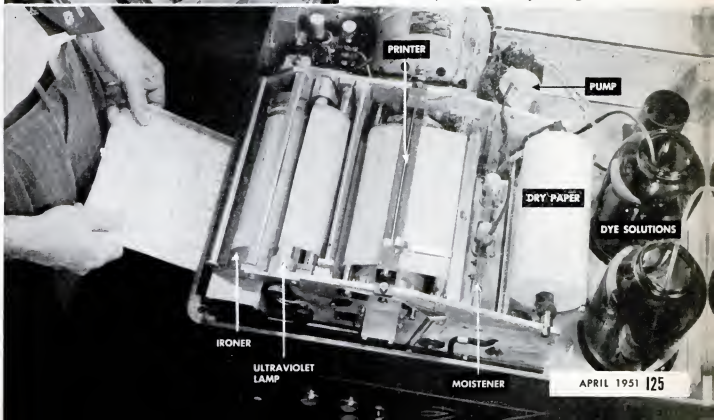
The box is the receiving end of a facsimile system that connects the research chemists at the Y-12 site to the central library at X-10, eight miles away. Facsimile sounds like an expensive way to route books and magazines. And it probably is—anywhere except in a big atomic-energy plant. At Oak Ridge, buildings are widely separated, scattered all over the rolling Tennessee countryside. Messengers have to pass through several sets of security fences and might need a number of different types of clearance papers to get by all the gates. And there's also the danger that irreplaceable library material might accidentally be made radioactive when taken into a laboratory. Nobody frets if a facsimile is ruined.

The system the AEC is now testing is a new one developed by RCA. It works fairly fast—about a page a minute—and is simple to operate. The librarian just puts the book or magazine in the transmitter's copy holder, turns a crank to set the degree of enlargement (fine print can be blown up four times original size), and presses a button. The receiver has only to be turned on. After that, the facsimile rolls out, dry and ready to be used, while the copy is being "read" in the transmitter.

Scientists 8 Miles Away



RECEIVER feeds signal to wire spiraling around drum (left), which produces across-page scanning by its moving contact with straight printer bar. At same time, paper is moving slowly forward. Signal-varied current flows through paper, reacting with diazonium dyes (applied to paper before it reaches printing drum) to create the printing. Paper then passes over ultraviolet lights, which bleach unprinted dye to "fix" facsimile permanently, then over ironer drum, which dries paper (below). Dye solutions are fed in exact quantities by tiny pump that uses screw action. Screw forces solutions along by squeezing rubber feed tubes, one screw squeezing both tubes.



REPORT FROM THE

DRIVER'S SEAT...

The clock was registering more than 110 m.p.h. when I opened up the new V-8 Chrysler on the Florida Keys. As the company calibrates its speedometers at plus or minus 2.5 m.p.h. at 90, speed was about as shown.

Shaw Reports on First U.S. Power Steering

The '51 Chrysler has it—and with a new engine. "It's a whale of an automobile," says America's most famous driver.

By Wilbur Shaw

I HAVE just driven the most powerful—and probably one of the fastest—stock sedans manufactured in the United States. It's the spanking-new 1951 Chrysler, with the first V-8 engine in the company's history [PS, March '51, p. 134].

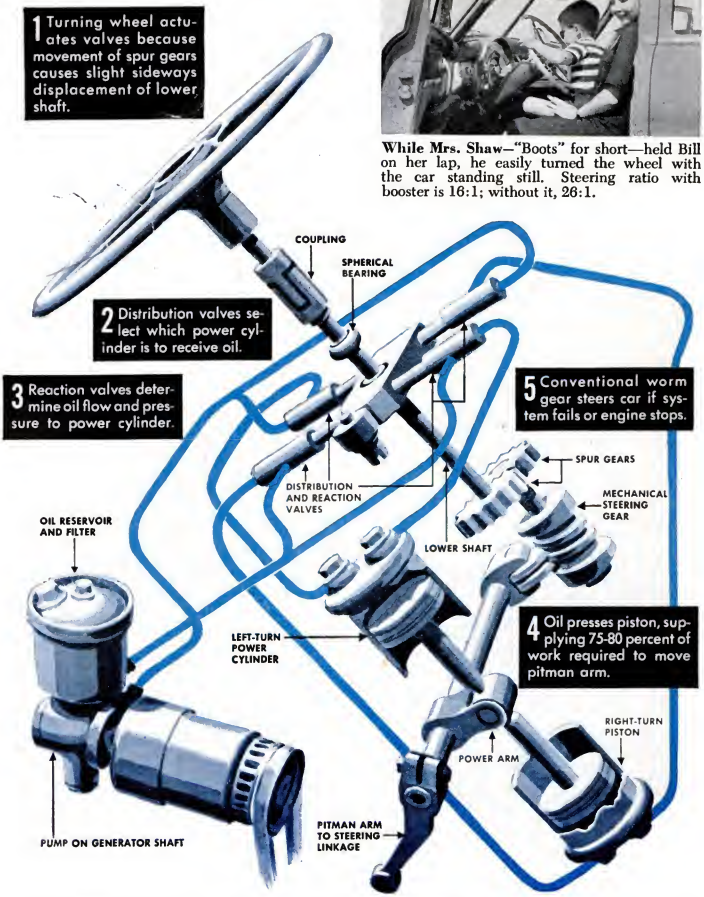
As astonishing as the performance of this engine is, it's only half the story on the new Chrysler. The rest of it is power steering, the first on any U. S. passenger automobile, and a new torque converter used with Chrysler's semiautomatic transmission and clutch.

That makes a lot of automobile in one package.

I was on vacation in Marathon, Fla., down on the Keys, when the opportunity came for me to drive this car, a New Yorker model. It promised to be an interesting experience because I had had no special reaction to Chryslers since the days of the Airflow in the mid-1930's. *That* was an automobile.

The driving was to be done in Miami, by courtesy of a local Chrysler dealer. But presently I found myself in Marathon and

While Mrs. Shaw—"Boots" for short—held Bill on her lap, he easily turned the wheel with the car standing still. Steering ratio with booster is 16:1; without it, 26:1.



Power-steering unit consists of four main elements: oil reservoir, pump, valves to distribute and control amount of oil flow, and pistons to assist in turning pitman arm. Real problem in power steering is to turn front wheels just so far—dictated by amount of rotation of steering wheel—and no further. Mechanism uses two sets of valves with distinct jobs. Distributor valves direct oil to proper piston for turning front wheels right or left. Reaction valves control amount of oil flow and bleed off pressure in opposite cylinder to maintain proper relationship between cylinders. Valves also regulate amount of "boost" provided—the ratio between manual and hydraulic effort on car's front wheels. Red lines indicate oil flow. In case of failure, steering is through the conventional worm gear and linkage.

This three-quarter view of the New Yorker model shows its pleasant lines. In the 200-mile drive from Miami to Key West and back to Marathon, the car lazed along even at 100.

then in Key West, the southermost city in the United States. There was a good reason for my taking the car on the trip over the Keys, and I'll come to that in a minute.

I drove the car briefly around Miami, feeling it out. Here's the start of the tape-recorded play-back of my impressions as I sat behind the wheel.

This power steering with the automatic transmission . . . the two things in combination . . . is the nearest thing to an automatic pilot for an automobile that I can possibly imagine . . .

Mr. T. B. McGahey, Miami Chrysler dealer, turned the New Yorker model over to me. Here he's showing me the hydraulic power-steering booster, developed jointly by Chrysler and Gemmer Mfg. Co. Power steering and new transmission are standard in Crown Imperial; optional in Imperial and New Yorker models.

I like this seating height. That's one thing you certainly can say for Chryslers . . . the seat puts you where you can see out, and that means safety . . . these windshield posts . . . I like the windshield posts. They're so small that even a child couldn't hide behind one of them out there in front of the car.

I was completely nonplussed by the ease of the steering.

Well, we've finally got it . . . power steering for passenger cars . . . and it's about time. With the supercushion tires used these days, it has been getting to the point where it takes real power to turn the wheel in parking. The only alternative to that is a high steering ratio and too-slow steering . . . I'm turning this wheel with one finger going only five miles an hour.

Acceleration "Incredible"

When I got back to the agency I remarked to Volney Landry, the engineer whom Chrysler had flown down from Detroit to answer my questions about the car, "Mrs. Shaw has got to drive this."

My wife weighs 112 pounds wringing wet. I had left her and my son Bill in Marathon when I came up to Miami. The sole reason for my trip down the Keys was to see what she thought about power steering. Her remarks on it are captured in a box accompanying this article.

Well, we took off for Marathon. And I mean just that. When I stepped on the accelerator from a standing start, the car really began making knots.

K. T. Keller, former president of the Chrysler Corp., once remarked facetiously that one great improvement in cars was chrome. For my money, the chrome treatment on the front end, and the styling, give this car classic lines. Brakes are vacuum-boosted.

This engine . . . I can't get over the amount of power and snap in this engine . . . even at 70 miles an hour, when I step on it the speed walks right on up . . . it's incredible . . . most cars begin leveling off on acceleration at this speed.

I was amused when later I sat down to listen to the playback of my reactions on the trip down the keys. I repeated, "Well, I'll be darned!" a half-dozen times as that engine and the steering wheel both responded instantaneously to any demands I made on them.

She won't kick down above 55 . . . the button under the accelerator pedal won't throw her down into the next lower gear above 55 . . . but you don't need it . . . not with this amount of power . . .

I don't get the least feeling of insecurity on this wheel at 100 miles an hour . . . this probably is the easiest car to drive that I've ever been in . . .

I was delighted with it. I remarked at one point:

The results . . . the performance of this steering gear is completely beyond your expectations. This is the easiest handling car imaginable.

Here is the remainder of my bits-and-pieces comments on the rest of the trip to Marathon.

There's some hood-bounce . . . more than the usual amount . . . the instrument panel is completely centered . . . and so are the controls, including the air vents and the heater . . . there may be some maintenance on the booster mechanism for the steering gear to keep it functioning properly . . .

It's pretty hard to describe this car with-

This proves that the clutch pedal is still there. You have to depress it to shift the lever on the steering-column quadrant. I'm afraid that the arrangement on the quadrant is going to make rocking the car in snow or mud a fairly hard job at least until you get the knack of it.

My son Bill got a kick out of this combination disappearing arm rest and child's seat. It put him up where he could see out. My wife remarked that the Chrysler rear-vision mirror was one of the few she had used since the advent of slant-back styling that really gave her a view of the road behind.

My old friend Captain Rickenbacker, the airline man, who was vacationing in Marathon, dropped by for a look at the new Chrysler.

The new engine is so short that they had to build a shroud behind the radiator to channel the air to the fan. My hands show the depth of the shroud. The new torque converter plus the gears give a maximum effective gear ratio of 3.75:1 in "high." Incidentally, the lowest horsepower registered so far on the dynamometers by the "180-hp." production engines now being manufactured is 185.6.

Some manufacturers are shy about putting safety pads on the dash to protect the front-seat passenger. Chrysler isn't. That's my wife's thumb on the pad to show its resilience.

out going off the deep end . . . this car has it in every department . . . it's a funny thing—Chrysler has been so ultra-conservative ever since it got ahead of the rest of the industry on styling with its Airflow—and paid for its mistake . . . and all of a sudden they go all-out on improvements like this.

It was 111 miles to Marathon. I rolled in there with a feeling that I had expended no more effort than I would have in driving around the block. There, Mrs. Shaw took her turn. I didn't say anything. I just had her get behind the wheel and start driving.

Mrs. Shaw Takes the Wheel

She started to haul away at the wheel, and the look she gave me was something to see. She was flabbergasted. I couldn't keep from laughing.

The next day we started on down the Keys toward Key West. I was driving.

This is a beautifully mannered car, either on a straightaway or a turn . . . and with a bad cross-wind too . . . it's almost an irresistible temptation to drive it fast because it rolls with so much ease . . .

The hemispherical combustion chambers in these V-8 cylinders are the same . . . they're practically identical with the ones in racing engines . . . valve-wise, it reminds me of the old Wills-St. Claire engine . . . it had extra-large intake valves and slightly smaller exhaust valves. It was a wonderful engine for its day . . .

There's a metallic click as you shift automatically from third to fourth gear in this job . . . to me, that's slightly objectionable . . .

The reason for that click is that Chrysler

FACTS ON '51 CHRYSLER

Make and model: Chrysler New Yorker four-door sedan.

Engine: V-8 overhead valve; 180 hp. at 4,000 r.p.m.; car weight per hp., 23.66 lb.; bore and stroke, 3 13/16" by 3¾"; compression ratio, 7.5, to 1; piston displacement, 331.1 cu. in.

Engine piston travel: (in feet per car mile at 20 m.p.h.) 1,485.

Crankshaft bearing surface: 43.8 sq. in.

Torque: 312 lb.-ft. at 2,000 r.p.m.

Transmission: Fluid-Matic automatic, four speeds forward, one reverse.

Rear-axle ratio: 3.73:1.

Steering ratio: 16.1 with power boost.

Diameter of turning circle: 45' 1" left, 44' 1" right.

Effective brake-lining area: 201 sq. in.

Suspension: front, coil; rear, semi-elliptic leaf.

Weight and outside dimensions: Shipping weight, 4,260 lb.; height, no load, 65¼"; over-all length with bumpers and guards, 213¼"; width, 75⅛"; wheelbase, 131½"; front overhang, 34⅛", rear, 47⅞"; tread, front, 57⅞", rear, 58 9/32".

Inside dimensions: Seat-cushion width, front, 57", rear, 58⅜"; legroom, front, 41⅞", rear, 41½"; headroom, front, 36½", rear, 36"; seat height, front, 15", rear, 15½"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5⅞"; front-seat adjustment, horizontal, 5"; vertical, 1⅛".

Tire size: 8.20 by 15.

This is what my wife thinks of the 1951 Chrysler:

Explaining power steering is my husband's department. But using it was mine. At first I could hardly believe the ease with which I could turn the wheel.

That's important. In the summertime, a woman likes to arrive at her destination still feeling fresh.

Often, after I have parked a car in an average parking space, I feel I should take a taxi home, shower, and get dressed again.

But not in this car. I parked it with one hand. It practically drives itself.

is still using its synchronized-shift semi-automatic transmission along with the new torque converter. The click is a characteristic of this type of transmission. It signals the change of gear through sliding clutch sleeves. You have to get used to it.

I feel a break in power . . . I get a complete loss of power when I press the kick-down button to go from fourth to third gear . . . for the smallest fraction of a second . . . I call that dumping it in your lap. A person should know about that before driving into any tight spots.

Volney Landry, the engineer, explained that to me later. The break is a momentary interruption of the ignition. That's necessary to permit the disengagement of the sleeve-type connection between the transmission gears. With the engine pulling, it's almost impossible to move the sleeve on the shaft.

The seating position is as comfortable as any I've ever found. The steering effort is just a fifth of last year's. Ratio can be cut as owners get accustomed to power steering.

There's creep in this transmission at a traffic light . . . there's creep in all of these new torque converters, except in Studebaker's, especially if the engine is cold and the automatic choke is boosting the idling speed.

At Key West I discovered something else. I hadn't been aware of it before, and it was the only serious fault I had to find with the new Chrysler—you can start the engine while the car is in gear. That's not good. It could be dangerous. With a regular one-two-three transmission, there's comparatively little risk if a person fires up while in gear. But with these newer transmissions, people get sloppy in their habits. As the driving effort goes down, carelessness goes up.

Chrysler can and should arrange a starter circuit so that the engine won't start unless the clutch is depressed or the selector lever is in neutral. This car retains its clutch pedal, even with the auto-transmission.

Mrs. Shaw did part of the driving back to Marathon. Her comments just about squared with mine.

Engine Surprised Even Chrysler

One word more about this new Chrysler engine—it was an evolution. It didn't start out as this engine at all. About five years ago the company engineers put hemispherical combustion chambers on one of their sixes, rated at 116 horsepower.

Imagine their satisfaction when they got more horsepower out of that six than they were getting out of their straight eight, rated at 135 horsepower.

Heretofore, engines with this kind of head have been prohibitively expensive to manufacture in American mass-production cars. It has been reserved to high-cost engines like those in aircraft and racing cars. Chrysler has undercut the piston heads for valve clearance like those in the high-cost engines.

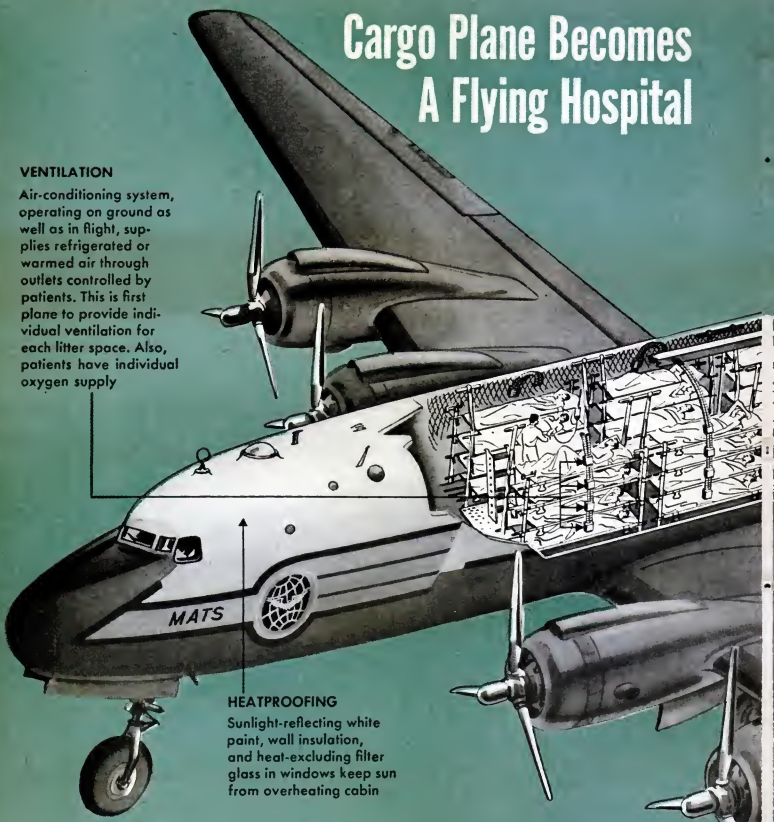
In fact, I think so much of this car that I've selected it as the pace car in the 1951 Indianapolis 500-mile race. **END**

This Month's Shaw-ism

The nuts aren't all on the car. Lots of them are behind the wheels.

Tilton Shaw

Cargo Plane Becomes A Flying Hospital



LAST word in a flying hospital is the plane illustrated here. After serving as a cargo ship or troop transport on the outward-bound leg of a round trip overseas, this convertible type becomes an air-evacuation plane to speed sick and wounded U. S. troops back home. A fleet of 30 of the craft has just been placed in operation, most of them in the trans-Pacific airlift, by the Military Air Transport Service.

Developed from the C-54 Douglas Skymaster, aerial work horse of the MATS, the new type is called the C-54M. As a hospital plane, it accommodates 32 litter patients with unprecedented facilities and comforts. New features include greater space between litters, vibration-damping litter slings, individual air conditioning controlled by each patient, hot meals from a galley, and medications from a built-in medical section.

Cargo occupies space used for patients on return trip

Convertible C-54M serves as cargo carrier, above, or hospital plane, below.

INSECT CONTROL

Exterior control, and pilot's control button, operate automatic insect-control system to avoid transporting disease carriers and crop pests from one country to another. System sprays insecticide from 15 nozzles into every crevice of plane before and after take-off

PATIENTS

Litters in anti-vibration slings accommodate 32 patients, with 18½-in. clearance. Brackets permit respacing litters for more headroom when fewer patients are aboard. Electrical stretcher lift gently loads and unloads two patients at a time. It can also handle cargo, in 500-lb. lots

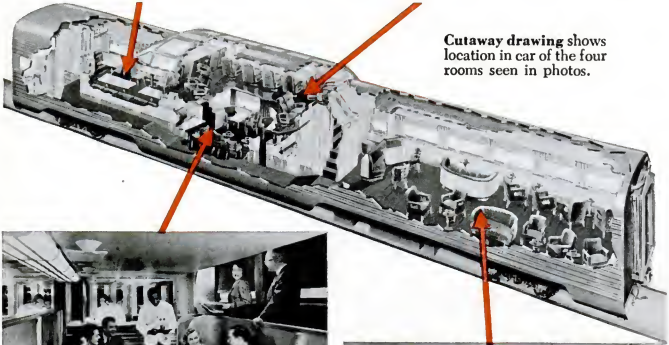
NURSE'S STATION

Headquarters for flight nurse and attendants has galley for preparing hot meals; medical station, with dressings, plasma, bandages, and surgical equipment; and intercommunication system linking medical and flight crews

New plane implements life-saving, morale-boosting U. S. policy of speeding wounded troops home by air rather than by water or rail.

Turquoise Room of lounge car is called only private dining room on rails in world. It may be reserved, in advance or aboard train, for luncheon, cocktail, or dinner parties.

Parlor Observation Dome caters to sightseers. Revolving parlor-type chairs, a new feature in dome cars, add to comfort of occupants and enable them to view scenery without craning.



Cutaway drawing shows location in car of the four rooms seen in photos.

Lower Cocktail Room offers refreshments from bar seen in background of picture. Entrance is from passageway, at right, that runs between Main Lounge Room and opposite end of car.

Main Lounge Room is spacious section with new arrangement of furniture, so that passengers face outward toward passing scenery, instead of having to stare at people on opposite side of car.

Luxury Lounge Car Gives Hotel Comfort

A FOUR-ROOM dome lounge car now in daily service on the Santa Fe's "Super Chief" gives railroad passengers the varied accommodations of an ocean liner or a hotel.

Private dining or cocktail parties of up to 10 or 12 persons are accommodated in the Turquoise Room, called the only one of its kind on any train. Other rooms are a Parlor Observation Room aloft for sightseeing, a Lower Cocktail Room for refreshments, and a spacious Main Lounge Room.

The car is part of a new line of equipment, built by Pullman and A.C.F., that's gone into service on the Super Chief.

Survival rifle, fairly accurate at 150 yards despite short barrel, is shown apart, assembled, and in use.

"Survival Rifle" Comes Apart to Make Small, Light Package

A COME-APART rifle that looks like a Woolworth toy is one of the Strategic Air Command's neater engineering feats. Remarkable for its light weight and compact design, it weighs only 3¾ pounds and makes a package only 14 inches long and two inches thick. An airman forced down far from civilization can use it to kill small game for food while awaiting rescue. Along with emergency rations, compass, and other essentials, it goes in a survival kit issued to members of bomber crews. The survival rifle is chambered for a .22-cal. Hornet cartridge and uses bolt action.

Quick-Rigged "Pillow" Tank Holds Armed Forces' Gasoline

TEN minutes' time makes ready a 10,000-gallon "pillow" tank for gasoline, developed for the armed forces at Fort Belvoir, Va. The collapsible tank of nylon-reinforced synthetic rubber is simply spread out on flat ground for use, as at left below, unrolling like a carpet from its carrying box (right, below). It saves days or weeks of time required to erect bolted steel tanks, and also saves the manpower required to float ashore and manhandle 55-gallon drums of gasoline. In a landing operation, the pillow tank can be filled by pipe line or hose line from small barges and tankers.

A striking feature of the new tank is the extreme overhang of the turret shown in side view above. This has a dual function—it pro-

New and improved 76-mm. gun gives T-41 more firepower than any previous light tank. Fast (35 m.p.h.) and maneuverable, it will be used for reconnaissance and flank protection. Pictures were taken at U. S. Army Ordnance Department's Proving Ground at Aberdeen, Md.

vides space for added interior gear and acts as counterweight for long gun barrel. Angle shot shows tank on 30-percent grade.

New Tank Goes Faster, Hits Harder

PS PHOTOS BY W. W. MORRIS

BRAND-NEW from the treads up, inside and out, here's the Army's first truly postwar tank. The T-41, shown at left in handmade prototype, is the forerunner of a new tank family that will include lights, mediums, and heavies (PS, Nov. '50, p. 117). It has been named the "Walker Bulldog," after Lieut. Gen. Walton Walker, killed in Korea.

Classed as a light, although it weighs about 25 tons, the T-41 is an outgrowth of the Army theory that a good, *all-purpose* tank can't be built. For this model, it wants a fast, maneuverable job for flank protection and reconnaissance, leaving bigger chores for the mediums and heavies.

So the T-41 isn't designed specifically to fight other tanks, although the Army claims it will be more than a match for the heavier, 38-ton Russian T-34. It does sport a new and more powerful 76-mm. gun, the biggest we've ever had on this size of tank.

Fast for its weight, the T-41 has an announced road speed of 35 m.p.h. It's powered by one of the Army's new air-cooled tank engines, a "pancake" type with opposed cylinders that develops 500 hp. "Wobblestick" steering and cross-drive transmission are other late tank features that are built into the new Bulldog.

New and improved fire-control apparatus greatly steps up the accuracy of the T-41's new gun. This means more first-round hits and, even more important, first-round kills.

Production models are to be built by Cadillac Division, General Motors. END

1 As arm swings forward, adhesive wheel touches right-hand page. Pressure on wheel trips switch that reverses motor, wheel picks up page, and arm starts back in opposite direction.

2 As wheel lifts page, metal finger attached to arm swings in behind page to help push it across. Finger drags plastic bar behind it that will hold down turned page under spring tension.

Mechanical Arm Turns Page for Handicapped

IT'S pretty tough lying in bed when you can't even turn the page of a book. But now this electric page turner will do it all for you—at the lightest touch of a lever. Invented by Frank Reck, of Flushing, L. I., for use by bedridden or physically handicapped patients, it has an easel that accommodates pocket-size magazines, as well as books. A volume is held on the stand by a horizontal bar and a spring clip that grips the back cover.

To turn a page, the patient merely presses lightly on a snap-action switch. This activates a mechanical arm that swings in a

Set up on a bed table, the machine below has an adjustable stand for tilting it. The switch resting on the patient's chest requires slight pressure to operate the page turner.

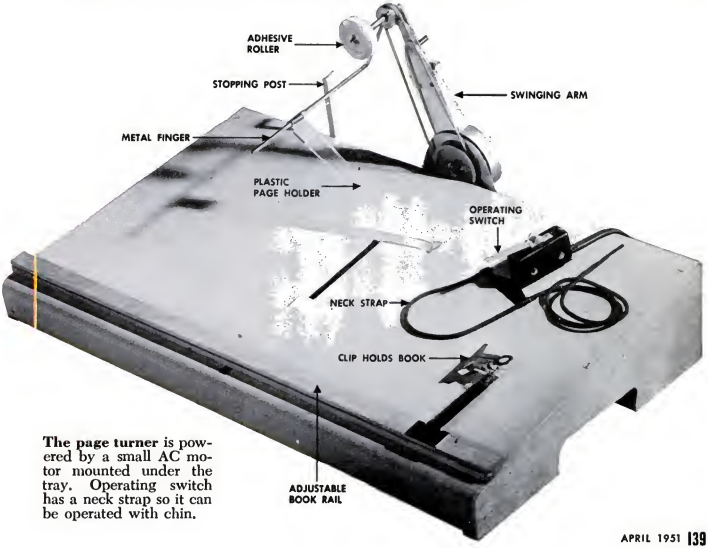
Arrow in close-up of arm points to reversing switch that is tripped whenever arm strikes page or stopping post. Pick-up wheel contains replaceable drafting tape wound around roller.

3 Toward end of swing, finger moves ahead of arm, pushing page out from under wheel and releasing it. Arm then hits stopping post that trips reversing switch to start it forward again.

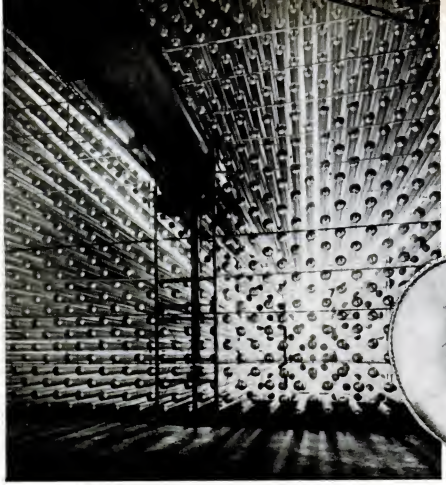
4 Arm continues forward until wheel touches new page, then repeats cycle. Machine can be stopped and started at any point in cycle and runs until operator releases control switch.

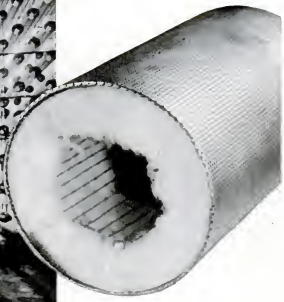
180° arc over the book, picking up pages with an adhesive roller. The pick-up wheel contains a roll of sticky tape that is wound around the outside of the roller. After 80 pages are turned, fresh tape is applied to the wheel. An AC motor supplies power.

Designed for both bed and wheelchair patients, the mechanical page turner also can be adapted for persons in an iron lung. The patient's arm, leg, or other part of the body can operate the switch. A neck strap lets a patient press it with his chin. General Textile Mills, Inc., of Carbondale, Pa., makes the device. END



The page turner is powered by a small AC motor mounted under the tray. Operating switch has a neck strap so it can be operated with chin.





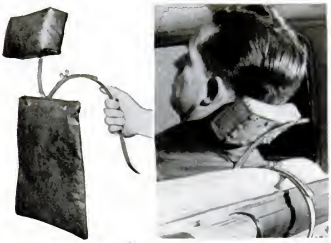
Fiberglas blanket surrounds inner hardware cloth. Outer covering is perforated aluminum. Units are 7½ feet long, 9 inches in diameter, and weigh 20 pounds. Solid caps cover ends.

Tubes Muffle Roar of Giant Engines

THE striking pattern above is formed by a bank of acoustical units used by the Curtiss-Wright Corp. to deaden the roar of 4,000-hp. aircraft engines running in test cells. The system utilizes perforated aluminum tubes packed with Fiberglas and suspended in staggered rows, one set at the intake and another at the exhaust end of a test chamber. In this installation are 3,600 units, with 61,200 square feet of acoustical area. The new sound absorbers, made by Janke & Co., Inc., of Hackensack, N. J., replace cast slag blocks formerly used.

Spectacles Give Side View

SPECTACLES with a built-in mirror were an unusual prescription filled by the American Optical Co., Southbridge, Mass. Because of a blind spot covering half the retina of the right eye—a defect called hemianopsia—the patient couldn't see cars or people coming from the right. The mirror makes them visible on the good part of the retina, ending danger and embarrassment.



Headrest Relaxes Auto Travelers

THE barber-chair headrest has been adapted to let auto passengers relax on long trips. It consists of a head support and shoulder pad (left above), and an adjustable brace that hooks over the seat of the car. Invented by A. P. St. Aubin, Union Gap, Wash., Ride-N-Rest is made in several colors and in two models, for front and rear seats. It sells for about $8.

If you like the out-of-doors, good sunglasses should be a part of your year-round play gear.

What Makes a Good Pair of Sunglasses?

By George H. Waltz, Jr.
PS PHOTOS BY W. W. MORRIS

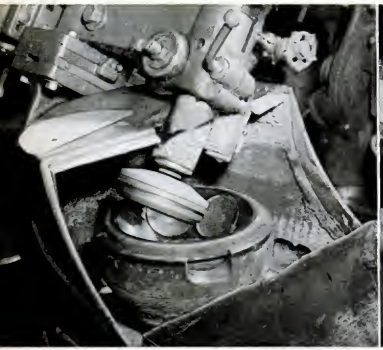
BECAUSE we are a sports-loving people who enjoy being out-of-doors as much as we can, we also are a nation of sunglass wearers. Last spring and summer, it has been estimated, Americans invested in more than 8,000,000 pairs of glasses designed to protect our eyes from the sun's brightness.

With another sun season about to get under way, PS's editors decided to investigate just what goes into a good pair of sunglasses. They told me to find out just what gives them their eye-protecting qualities, why they can be sold at such a wide range of prices, and what the average person should know about their selection and use.

Obviously, the best spot to find the an-

1 Square of tinted glass, heated until soft in furnace, is put in a round mold that in turn is placed in a press. Lens blank formed is then slowly annealed to eliminate strains.

2 Preparatory to grinding first side, lens blanks are mounted in a block (held in the worker's hand). Block is placed over the form holding lenses, and hot pitch is poured in.



3 Lenses held in block by hardened pitch are then given a first grinding with a diamond wheel. In the ophthalmic trade, this operation is known as "generating the first curve."

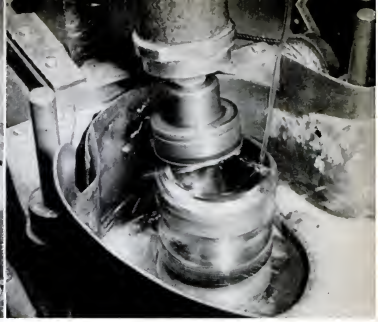
4 Final grinding and polishing of the first side are done in machines like these. Block is held over turning dome. Abrasive and water are used for grinding, rouge for polishing.

swers to those questions was at a sunglass factory. So Bill Morris and I toured eastern Massachusetts and visited three plants of the American Optical Company. We were surprised at the number of people and the amount of special machinery and equipment that had to be employed to turn out the sunglass production for just one large company. We saw batteries of lens-blank molding furnaces, row upon row of optical grinding and polishing machines, bench after bench manned by lens inspectors, an entire plant given over to the production of top-quality sunglass frames, and another devoted entirely to the making of inexpensive molded frames fitted with plastic lenses. There was a lot of ground for us to cover.

What Makes Good Sunglasses

It didn't take long before we discovered that there's more to the making of a good pair of sunglasses than meets the eye that looks through them. They're not just circles of colored glass held in frames. To be completely safe and effective, they must accomplish three basic things—cut down glare and reduce to safe limits the amounts of infrared (heat) and ultraviolet (sunburn) rays reaching the eyes. Furthermore, they must be free of such imperfections as bubbles, waves,

5 After first side is ground and polished, block is placed in refrigerator to shrink the pitch so lenses can be removed. This step in the process is called "picking off."



6 Second curve, on other side of lens, is generated on another grinder fitted with a diamond wheel. In this operation, lenses are handled separately and not mounted in a block.

7 To grind and polish second side, lenses then are mounted on a dome-shaped block. Heated lenses are placed on pitch and pushed firmly into place with a short wooden stick.

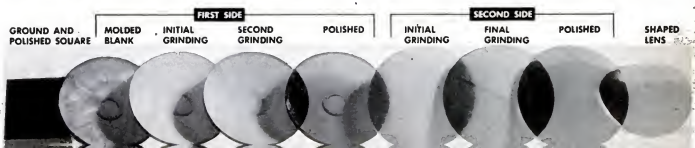
8 Second side is then ground and polished. In this case, the lens block revolves. Edges of the finished lenses then can be ground down to shapes to fit various styles of frames.

scratches, and unintended focal and prismatic power.

A wide variety of sunglass lenses and complete sunglasses are made at the American Optical Company plants. They range from sun lenses carefully ground to specific eyeglass prescriptions through quality sunglasses having optically ground lenses to cheaper ones with plastic Polaroid lenses.

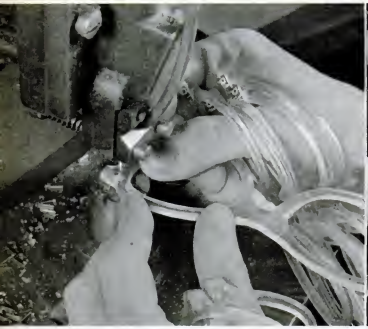
Optically ground and polished sun lenses start out in life as squares of glass that have been colored by adding metallic oxides. Heated to softening point, they are placed in round molds and by means of pressure are formed into rough lens blanks having the proper curve (known as a "6 base curve"). After a series of careful grinding and polishing operations—first with a special

Nine steps from glass square to finished lens.



9 **Rough frames** and temple strips are stamped out of sheet plastic. To ease the job for the press, and to get a cleaner stamping, material is warmed before being fed into press.

10 **Vertical revolving cutters** are used to shape the stamped-out frames and to cut the grooves inside the rims that later will hold the sunglass lenses in place.



13 **Tiny rivets** to hold the metal hinge parts on frames and temples are driven into place through both plastic and hinge by an automatically fed, foot-operated power press.

14 **Miniature riveting machine** then heads over the tiny rivets to hold the hinge halves firmly in place. Girls operating motorized screwdrivers then screw in hinge pins.

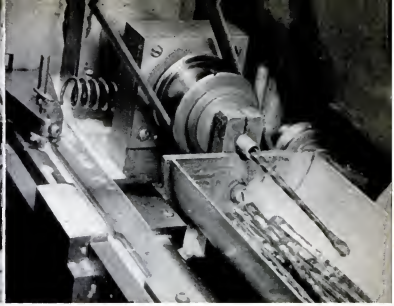
diamond wheel, then with corundum and water, and finally with rouge—these rough blanks emerge as finished lenses whose edges then can be ground down to shapes to fit various styles of frames.

The frames start out their lives as flat sheets of plastic (Zylonite). After stamping, shaping, finishing, and assembling, they end up with their rims being heated on metal blocks so they will expand just enough to allow the glass lenses to be fitted securely into place.

Careful and repeated inspection is an integral part of the whole process. Both lenses and frames must meet specifications. And when lenses and frames become one, they are adjusted as a unit to insure proper fit.

At another American Optical plant, we saw how less expensive glasses are turned out. Here, to save the consumer money, frames and temples (the parts that go over your ears) are turned out in rapid-fire order in injection-molding presses. Powdered plastic is simply poured into hoppers, heated, and injected under pressure into gang molds that can form four complete frames in 26 seconds and enough temples to go with them in the same length of time. Assembly is streamlined to trimming off a few rough spots with a sharp knife, milling the grooves to take the lenses, drilling the holes in the cast-in hinges, heading over hinge-pin rivets, and snapping the plastic Polaroid lenses into place. Mass production makes it

11 **Rough blank** for a temple (the part that goes over your ear) is made up by placing a reinforcing wire between two grooved strips, cementing them together, and trimming to size.



12 **Cam-operated machine,** like automatic lathe, then shapes each temple blank to the desired form. The flat cam, which controls cutters, can be seen in the left foreground.

15 **Putting lenses in place.** After completed frames have been cleaned and buffed, rims are enlarged by placing them on heated metal blocks and lenses are snapped into place.

16 **Good fit** is important in sunglasses. Last step before packing is a careful inspection and adjustment of temples and frames to pattern mounted on inspector's workbench.

possible to turn out such sunglasses at a moderate price.

What You Should Know About Sunglasses

1. There's no easy way for the layman to test the quality of sunglasses. Buy a pair made by a reputable manufacturer.

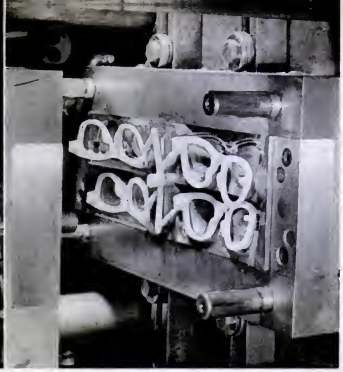
2. Also make sure that any pair of sunglasses you buy fit you and are comfortable. Remember, the various styles of sunglasses usually are made in a variety of sizes.

3. Don't try to adjust a pair of sunglasses by bending the frames or temples yourself. This is particularly true of Polaroid glasses. If the vertical axes of the two lenses are off more than 3°, they may cause strain.

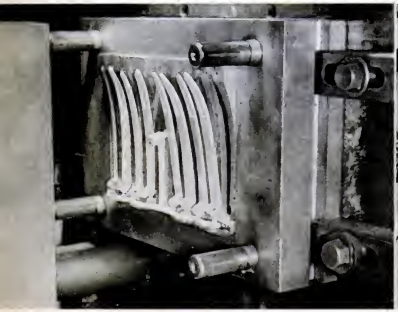
4. Treat your sunglasses like a pair of

What sunglasses are made of. Here is what goes into a pair of quality sunglasses as made by the American Optical Co. It takes some 60 operations to put the parts together.

Inexpensive sunglasses consist of frames and temples cast in an injection-molding machine. Powdered plastic is poured into hopper, heated, and forced into the mold under pressure.



Four frames, complete with their plastic hinge halves, are cast in a single operation. The cycle for each "shot" on the injection-molding machine takes a total of 26 seconds.



While frames are being molded on one machine, temples are being formed in another. Parts come from mold so clean that only finishing required is removal of flash with a knife.

Plastic Polaroid lenses are then snapped into place after hinge pin has been riveted into place. Because the lenses are flexible, no heating and enlarging of frames is necessary.

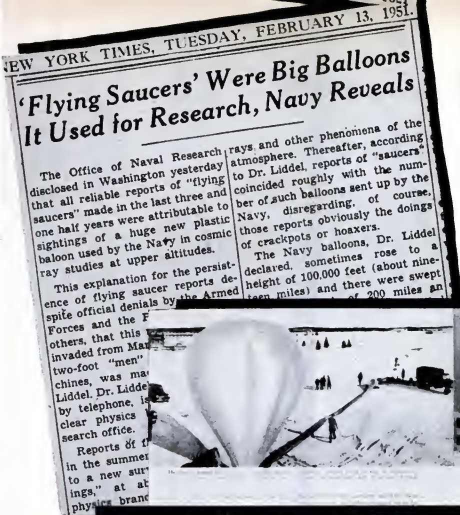
glasses. Keep them in their case when not wearing them. Protect them from scratches and grit.

5. If you ordinarily have to wear glasses for good vision, have sunglasses ground to your prescription, or buy a pair of clip-on sun lenses that can be slipped on over your regular lenses.

6. Don't wear sunglasses indoors, or when the level of outdoor illumination is low. Sunglasses were designed to protect your eyes from brilliant illumination.

7. Don't wear sunglasses as night-driving glasses—they weren't designed for it. END

When lenses and frames have been joined, finished sunglasses are inspected as a unit. Polaroids get a careful check to make sure polarizing plane runs in right direction.



NEW YORK TIMES, TUESDAY, FEBRUARY 13, 1951.

'Flying Saucers' Were Big Balloons It Used for Research, Navy Reveals

The Office of Naval Research disclosed in Washington yesterday that all reliable reports of "flying saucers" made in the last three and one half years were attributable to sightings of a huge new plastic baloon used by the Navy in cosmic ray studies at upper altitudes.

This explanation for the persistence of flying saucer reports despite official denials by the Armed Forces and the F... others, that this ... invaded from Mar... two-foot "men" ... chines, was ma... Liddel. Dr. Lidde... by telephone, is... clear physics ... search office.

Reports of f... in the summer ... to a new sur... ings," at al... physics branc...

rays and other phenomena of the atmosphere. Thereafter, according to Dr. Liddel, reports of "saucers" coincided roughly with the number of such balloons sent up by the Navy, disregarding, of course, those reports obviously the doings of crackpots or hoaxers.

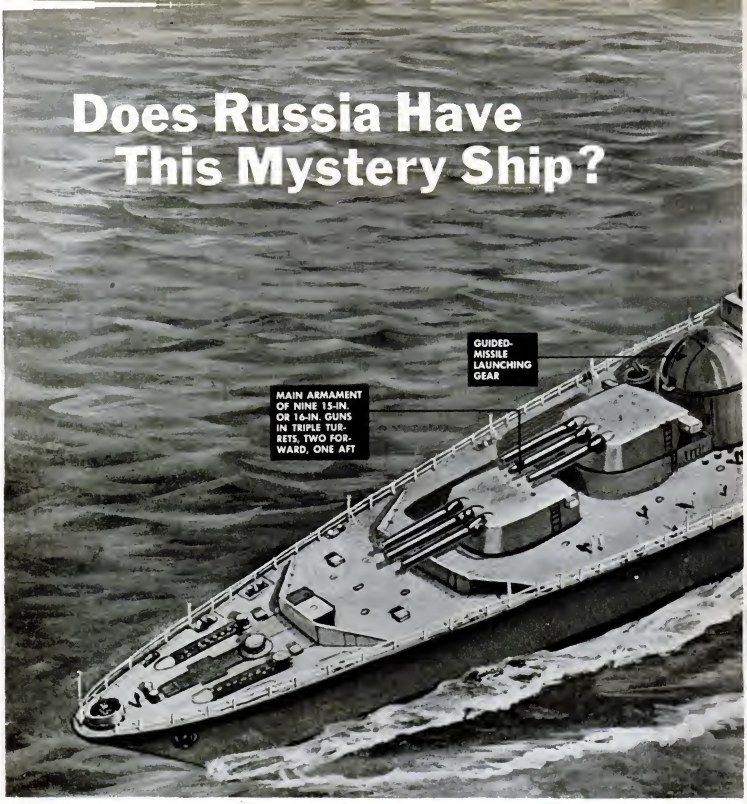
The Navy balloons, Dr. Liddel declared, sometimes rose to a height of 100,000 feet (about nineteen miles) and there were swept ... of 200 miles an

Saucers Balloons? The News Catches Up to PS

WHEN the press recently headlined the news that flying saucers were really Navy balloons, PS readers could say, "Aah, old stuff."

For a May 1948 POPULAR SCIENCE story on these plastic balloons (above) reported, "Such pin points [the balloons] . . . may be the innocent source of the 'flying saucer' stories." Now Dr. Urner Liddel, Navy physicist, concludes they were indeed. But does that take care of the three-foot-tall men from Venus? END

Does Russia Have This Mystery Ship?

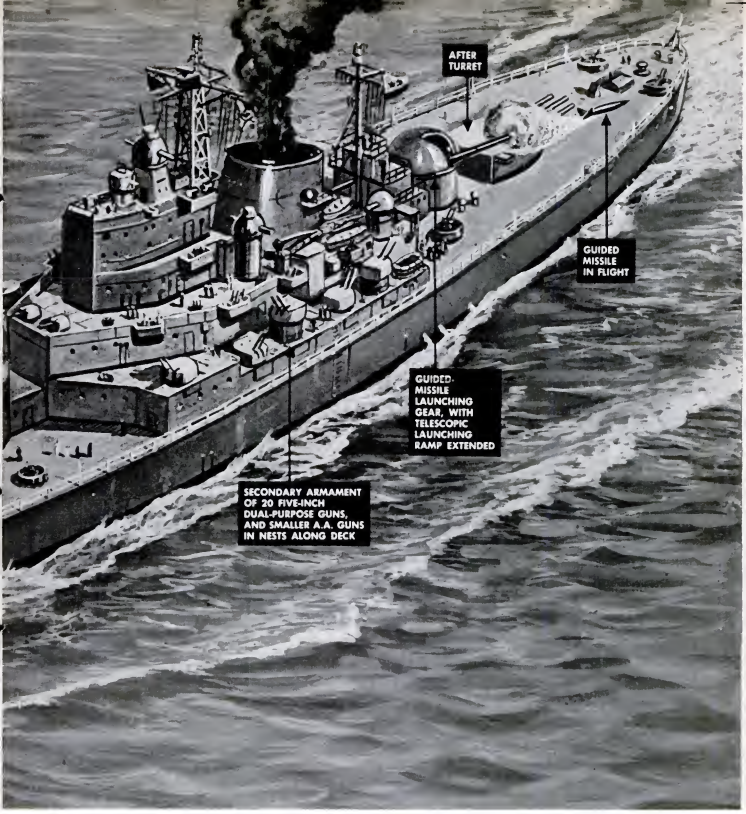


DOES Russia have new battleships firing guided missiles as well as shells?

In the picture above, a British naval artist sums up a crop of rumors that have reached the Western world of Soviet mystery ships. According to these:

A new Russian class of battleships consists of three sister vessels for service in the Baltic and Black Seas. One laid down at Leningrad in 1939, the *Sovietski Soyuz* (Soviet Union), suffered German bomb damage during construction and may still be unfinished. But two more being built at Archangel, the *Strana Sovietov* (Coasts of the Soviet) and *Sovietskaia Byelorussia* (Soviet Byelorussia), may now be completed.

The new Soviet type, the rumors say, is a 45,000-tonner of more than 200,000 hp., with a maximum speed of 33 to 35 knots. Its armament includes a main battery of nine 15- or 16-inch guns, secondary armament of 20 five-inchers for use against surface craft or aircraft, and smaller antiaircraft guns. So far the description of the mystery ships closely resembles that of the largest U. S. battleships—the 45,000-ton, 16-inch-gun *Iowa* class. But the Russian ships are said to be shorter, 860 feet; wider, with a



130-foot beam; and shallower, with a 29-foot draft.

They are also said to have one outstanding novelty—a pair of domed launching towers for guided missiles, which would extend the range of bombardment and might conceivably have atomic warheads. Such equipment has no counterpart in the world's capital ships as yet. (Pending guided-missile development, work has been suspended on the unfinished U. S. battleship *Kentucky* and large cruiser *Hawaii*, which were to have been armed with missile launchers instead of big guns. However, a current U. S. program includes converting a heavy cruiser into a guided-missile ship for use "primarily against aircraft.")

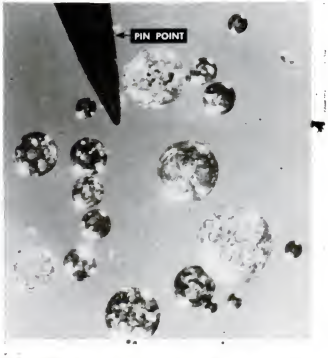
The figures and speculation about the Russian ships may or may not be correct. Verified information is difficult to obtain this side of the Iron Curtain. But battleships are sizable things to try to conceal—and at least once before, rumors about them turned out to be right. These told, before World War II, that Japan was secretly constructing the biggest battleships ever built—the monster 63,000-ton *Yamato* and *Musashi*, sunk by U. S. carrier planes. END

"Knee-Action" Wings Cushion Ride in French Plane

"KNEE-ACTION" wings smooth out bumpy air for the Rey, an experimental plane test-flown near Paris this winter. Each wing is made in two sections that are connected by rubber disks. Torsion of the disks provides the "spring" action—an angle as great as 30° between wing and fuselage is possible. The plane, under development since 1938, carries two people and can reach 205 m.p.h. with its two 220-hp. Renault engines.

Nylon Gets in "Wolf's Clothing"

THE Air Force is borrowing a trick from women's fashions—fake fur. Only the glossy "pelt" in the photo above isn't even from a humble rabbit—it's actually nylon fiber on a rubber-coated cotton backing. The phony is under test to replace real wolf fur as a trimming for Arctic parkas. The wolf fur warms air breathed in by the wearer, preventing frostbite of his lungs. The phony wolf was developed after such combinations as horse hair plus alpaca and nylon with cow's tails had been tried.



"Hot" Beads Aid Medical Research

THOSE pretty glass beads are "hot"—not stolen, but radioactive. Made by a new technique that incorporates radioactive elements into the glass, they provide an easy way to irradiate tissues inside an animal in medical experiments. The beads are simply imbedded in the tissue. In this way, for example, the liver of a rat was exposed to known, varying doses of radiation. The beads are very small—about the size of a pin point—so they can be easily inserted and their radiation localized.

At Syracuse University's Hearing and Speech Center, hundreds of children who have been born with impaired hearing, like this boy, hear their first sounds and learn to talk.

Electronics Helps Teach Deaf to Speak

New techniques are helping once-deaf children to hear, speak—and lead a normal life—for the first time.

By George H. Waltz, Jr.

PHOTOS BY DAN OWEN

PICTURE a small child sitting on her mother's lap. On her head she is wearing a pair of earphones. Taped to each hand are some metal electrodes. Her hands are perspiring a bit. Then, suddenly, it happens. For the first time in her life, Jane P.—age two—hears a sound.

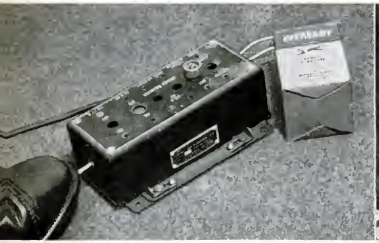
Jane is just one of hundreds of deaf children under care at Syracuse University's Hearing and Speech Center, where, through the use of special electronic equipment and training techniques, they are hearing their first sounds and uttering their first words. There, perspiration on the two-year-old's hands helped experts prove that Jane *could* hear—if the sound was loud enough—and thus could learn to talk. As a result, Jane and many others who would otherwise have to attend special institutions will be able to be normal students in regular schools.

When Jane first came to the Center, she, like all new patients, was given a loss-of-hearing test. That's when the perspiration on her hands showed that she could hear. The test was made on a skin galvanometer, which operates on the principle that sweating increases momentarily whenever someone is stimulated by a sound or an electric shock. The increased perspiration lowers the skin's electrical resistance. By taping electrodes to a patient's hand, this change in resistance can be measured.

In a hearing test, two additional electrodes connected to an electric shocking device are taped to the patient's other

First step with a new patient is to determine exact amount of hearing loss. This is done on the Center's skin galvanometer, which is one of three such instruments in the country.

Device operates on principle that stimuli like sounds or shocks increase sweating, reducing skin's electrical resistance. Galvanometer records changes through electrodes taped to hand.



In hearing test, electric shocking device (left above) is wired to patient's other hand and earphones are placed on his head. Every time tone is sounded in earphones patient gets a shock. When patient responds to tone alone, shock is eliminated. Volume is then reduced until galvanometer indicates no hearing. Hearing loss shows on dial on panel at right above.

Nursery school. Wearing earphones connected to a central microphone and amplifier, the youngsters play like children in any kindergarten. Here, Dr. DiCarlo, the Center's director, is teaching them words by holding up objects and naming them. By patient repetition, he gets the children to imitate. Gradually, they learn to speak their first words.

In speech classes, the youngsters, wearing earphones connected to a central amplifier, sit at a semicircular table directly under a sensitive microphone. This makes it possible for them to talk to each other as well as to the instructor, who generally stands at the control console in foreground. Each child has a volume control for his earphones.

hand. Earphones, attached to an electronic device that can produce tones of known loudness and frequency, are placed on his head. By sounding a tone and then giving the patient a harmless shock, a conditioned reflex is set up. After a few times, the patient, anticipating the shock, begins to respond to the tone alone. The loudness of the tone then is gradually reduced until there is no indication of hearing on the galvanometer. The loudness at that point, which can be read on a dial, indicates the patient's threshold of hearing.

If there is sufficient residual hearing, Dr. Louis DiCarlo and his staff use a glorified hearing aid consisting of a microphone, powerful amplifier, and earphones to talk to the child. The mother uses the same equipment at home. By holding up objects and naming them, they slowly teach the youngster words. Gradually, through repetition and imitation, they get the child to utter sounds and then words. As the children advance, they attend nursery school and speech classes where they wear earphones wired to a central microphone and amplifier. Finally, those children whose hearing is not too badly impaired are fitted with hearing aids. The others concentrate on sound cues plus lip reading.

The Center, supported in part by the N. Y. State Society for Crippled Children, also assists adults who need conventional hearing aids. It prescribes the type best fitted to the individual's needs and then teaches him how to use it. END

Hard-of-hearing adults come to the Center to be fitted for hearing aids. Seated in a hearing-evaluation room, patient tries various types of aids to find one best suited to him.

Panel outside soundproof room allows operator to feed controlled sounds and tones to loudspeaker in room. In this way, each type of hearing aid can be tested against standards.

Compressed Air Works for Pilot

THE air a plane flies through may soon help the pilot work his controls. Compressed air is being tested as a power source for operating landing gear, wing flaps, brakes, and control surfaces (above).

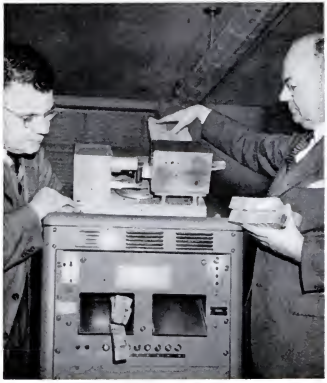
A new lightweight compressor being used in the tests can be driven by the airplane engine itself, or by an auxiliary motor, and promises many advantages over hydraulic systems now used. According to Walter Kidde & Co., air works faster, is completely fire-safe, and is not bothered by low temperatures. The new compressor weighs less than 16 pounds. It can deliver four cubic feet per minute at 3,000-pounds-per-square-inch pressure.

Parking Garage Without Roof or Walls Expands Easily

A COMBINATION parking garage and shopping center is the latest remedy suggested for the traffic headache tormenting American cities. A parking unit, held by designer Lloyd Aldrich, Los Angeles engineer, has no roof or walls. Thus it can be expanded sideways, or upwards, as at far left, by adding more supporting pillars and floors. Stores could receive deliveries at back doors from trucks unloading inside.

Removable Litters Convert New York Buses to Ambulances

ATOMIC casualties could ride in buses, according to New York City's civil-defense plan. Four hundred vehicles from the big town's huge bus fleet will be equipped this spring to carry litters like those city officials are inspecting in the test model above. Each bus can hold 16 of the litters, which are easily removable.



Electric Eye Counts Money

YOU'RE right—the only guy who needs a money-counting machine these days is the Secretary of the Treasury. Above Mr. Snyder (right) inspects his department's newest device, which checks the count of 100-bill packets by wrapping the packets around a spindle, then releasing one bill at a time to be flipped past an electric eye.

Metal TV Tubes Now Rectangular

COMBINING the "square" TV screen with the metal-shell tube promises to help make better television sets cheaper. The rectangular shape permits smaller cabinets, while the light metal tube permits simpler cabinet construction. Together they slice cabinet costs, a considerable item in the total price. RCA makes the 17-inch tube.

Atomic Piles and Sparking Flints Put Zirconium to Work

In an atomic pile, left, zirconium excels as a structural metal. Shower of sparks, when

A new process yields a once-rare metal by the ton, permitting large-scale application of its valuable properties.

By Alden P. Armagnac

THERE'S a new wrinkle in building atomic piles. The man in charge of developing them for the Atomic Energy Commission, Dr. Lawrence R. Hafstad, recently hinted at it:

"Our worst bottleneck has been production in pure form and ton quantities, for structural purposes, of a chemical element which until a year ago was one of the curiosities of the periodic table."

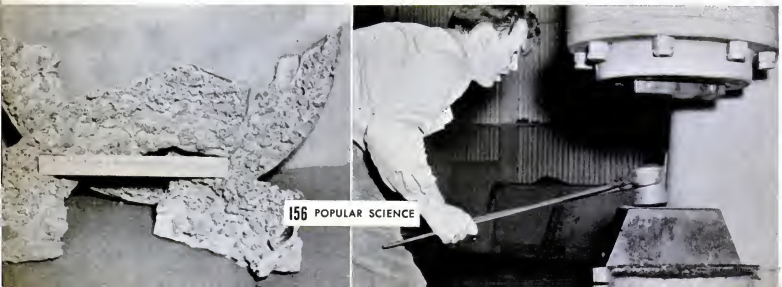
The new pile-building material is the lustrous and silvery metal known as zirconium, the AEC now reveals.

Pure zirconium meets the specifications of atomic-pile builders for an odd reason. Its power of absorbing neutrons, the flying particles that cause a pile's chain reaction, is exceptionally low. So zirconium can go into the heart of a pile without appreciably hindering the reaction, as steel or other common metals would, by taking neutrons out of circulation.

Rods and sheets of zirconium that can be fashioned into useful shapes are something new. Zirconium-metal powder has been available before; but the solid metal has been considered brittle and unworkable, except when purified at prohibitive cost.

Zirconium metal comes from distilling retort in "sponge" form below, in Bureau of Mines plant at Albany, Oregon. Foot rule shows size of porous chunks, which total about 100 pounds.

Solid ingot has been made from sponge zirconium in vacuum melting furnace. It is forged (below) and rolled in sealed iron jacket, as exposure to air makes hot zirconium brittle.



Zirconium-alloy flints, in sizes suited for cigarette lighters, welding torches, and other devices, are shown with lumps of the alloy from which they are made.

lump of zirconium alloy is drawn along file, demonstrates its utility for lighter flints.

Only five years ago, ductile zirconium was so rare that it sold for $500 a pound.

Now U. S. Bureau of Mines experts, who have developed an economical new process at an Albany, Ore., pilot plant, are turning out ductile zirconium by the ton.

Their factory has recently been enlarged to produce more than 2,500 pounds weekly. And commercial producers, using other improved methods, are augmenting the zirconium supply.

Silvery zirconium is a strong metal, five-sixths as heavy as steel, with an unusually high melting point of more than 3,000° F. Besides these desirable qualities, zirconium has many others, fitting

By these stages, ingot of iron-jacketed zirconium (left end of top row) is transformed into finished forging (right end of bottom row), ready to be rolled into sheet metal.

Lustrous sheet of silvery-hued zirconium metal emerges, ready to serve novel uses, as flattened sheath of protective iron is stripped from it after composite piece has been rolled.

Wrench of solid zirconium was experimentally made from rod with same dies as for steel wrenches to demonstrate ductility. Here it is before and after trimming drop-forged blank.

Aircraft wheel made from Z5Z alloy of magnesium, zinc, and zirconium has high strength-weight ratio. Foot rule shows size of wheel, a product of Howard Foundry Company, Chicago.

it for various special uses that quantity production will make possible.

While the AEC isn't telling how piles will employ zirconium, the U. S. Bureau of Mines suggests: "It seems apparent that its use in place of aluminum for the jackets that house the uranium-metal slugs would permit operation at temperatures well above the melting point of aluminum, which is now presumably a limiting factor." Zirconium should likewise serve well for the tubes holding the jacketed slugs in graphite-uranium piles; and for tanks holding uranium solution, or heavy water, in other designs. Coolant-circulating tubes might be made of zirconium, too. Latest thing for a pile's coolant is a liquid metal of low melting point. And such a sodium-potassium alloy has proved unable to corrode zirconium in six days at red heat.

Principal use of zirconium to date has been for devices producing dazzling light. In photographers' flash bulbs, a burning mixture of zirconium and oxidizing agents furnishes all the light of some types, and ignites shredded aluminum foil in others. Lamp bulbs resembling vacuum tubes, with zirconium cathodes, have provided a brilliant pin-point light source for microscopes and photographic enlargers (PS, July '46, p. 98). More recently a zirconium open-air arc has been developed that improves projectors and searchlights.

Zirconium, like cerium and a few other rare metals, is pyrophoric, or spark-producing. Cigarette-lighter flints of zirconium alloy, giving a hotter spark than ordinary cerium flints, were marketed during the last war when cerium's scarcity enabled them to compete in price. They may reappear in stores as zirconium becomes more plentiful. Industrial-size sparking flints are currently made of this same zirconium-lead alloy, produced by Metal Hydrides, Inc., of Beverly, Mass. It doesn't deteriorate in warm or moist air, and will spark even when wet.

New Uses Await Zirconium

Rings, jewelry, and knives, forks, and spoons of pure zirconium are promised by reason of its exceptional resistance to tarnishing and corrosion at ordinary temperatures. Surgeons are interested in zirconium for bone screws and plates; engineers, for acidproof chemical vessels and equipment; scientists, for the tiny metal weights used with their precision balances.

Zirconium makes valuable alloys, too. A gold-zirconium alloy, hard and corrosion resisting, may replace platinum-iridium in fountain-pen tips. Cast iron made ductile by adding zirconium will serve some of the purposes of steel. Airfield landing mats of a magnesium-zinc-silver-zirconium alloy, combining lightness and tensile strength, are under Army development. Aircraft parts currently are being made of various light and strong magnesium alloys with zirconium, and whole planes of magnesium-zirconium alloy are reported on the way.

Zirconium's principal ore is zircon, chemi-

Tiny electrode of zirconium, held at left, forms open-air arc in new high-intensity Telcoarc lamp. This electrode burns equivalent time of seven carbon-arc electrodes, at right.

Telcoarc lamp is one-eighth as bright as sun. Its inventor, W. D. Buckingham of Western Union Telegraph Company research staff, views the open-air zirconium arc through dark filter.

Zirconium-lit movie screen, right, proves four times as bright as tungsten-lit screen at left. Telcoarc and standard tungsten lamps of 1,000 watts each are in 16-mm. projectors for test.

cally a silicate. Zircons, the beautiful white and colored gem stones from Ceylon and Thailand, are large, pure crystals of this silicate. In cruder form, zircon ore is abundant. Black zircon sands of Florida beaches furnish the domestic supply.

To extract the metal, the new Bureau of Mines process begins by heating zircon sand with graphite. Resulting carbides, treated with chlorine gas, yield separable chlorides of zirconium and silicon. In a reduction furnace, the purified zirconium chloride gives up its chlorine to molten magnesium. Spongy zirconium metal remains. It is freed of impurities in a distilling retort, and then melted down into solid ingots of up to 25 pounds each.

Secret of the method's success lies in excluding air, which robs hot zirconium of its ductility and makes it brittle. Vacuum and helium-filled furnaces do the heating. Even the finished ingot is shielded from air by sealing it within an iron jacket, for forging and rolling. Then the protective jacket is peeled off, and the shiny zirconium is ready for its new uses. END

Pilot stands alongside Schweizer Type 1-23. Wingspread is 44 feet, weight 450 pounds.

Pacific winds passing over the Sierra Nevadas produce unique air waves in Owens Valley that lifted sailplane vertically to beat former 33,500-ft. record.

Heavy clothing and oxygen mask were Ivans' only protection against the subzero cold and rarefied air. Instrument panel includes magnetic compass, altimeter, airspeed meter.

Pilot Riding Air Currents Sets New Sailplane Record

IMAGINE yourself soaring into the sky, higher and higher, until you're eight miles above the earth. And without propellers, jet thrust, or angel's wings. Impossible? Not for Bill Ivans, a San Diego aircraft worker who recently shattered the world record for sailplane altitude flight.

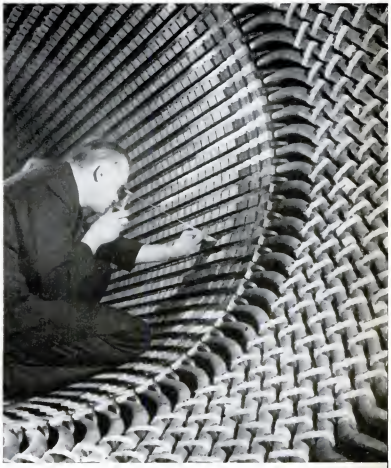
Canopied between the wings of his all-metal sailplane, Ivans rode the stiff air currents over Bishop, California, to a height of 42,000 feet. Gusts from the nearby Sierra Nevada mountains lifted the plane almost vertically, at times as much as 2,500 feet a minute. It took Ivans two hours to reach his peak; a 45-minute glide took him down.

Portable Signal Unsnarls Emergency Traffic Jams

THE portable traffic signal at left generates its own power supply. It was designed by Newark, Ohio, city officials for emergency use at accidents, fires, parades, football games, and drive-in theaters. It stands 90 inches high, and is mounted on rubber-tired dolly wheels for quick towing to any part of the city demanding emergency traffic control. In the base is a 400-watt, gasoline-powered generating plant that produces the 110-volt current necessary to operate the controls and lights. With a larger gasoline tank installed, it is estimated that the signal could operate for 20 hours without attention. If needed, it can show a steady red light.

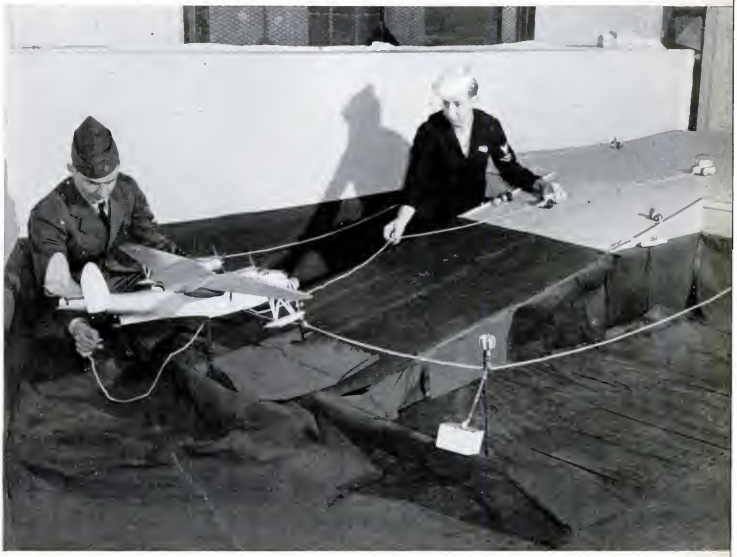
Generators Get "Medical" Checkup

The "doctor" peering into the cystoscope at right is really an engineer, checking up on a giant generator. Use of the standard clinical instrument—which lets doctors look into dark corners of the human body—permits a close visual examination of the wire insulation deep inside the generator's coils. Periodic physical checkups help Westinghouse engineers find hidden weaknesses so that correction can be made before serious breakdowns occur.



Navy Model Helps Land Seaplanes

The men below aren't playing with toys—they're solving seaplane-landing problems on a scale model of a beaching ramp. Designed by Chief Petty Officer Osie H. Gay, the replica provides a PBM, boats, tractors, and towlines at a cost of only $15. Typical beaching problems are set up and then photographed for reproduction in training manuals. Use of these pictorial problems at the Naval Examining Center, Norfolk, Va., eliminates training men with real planes and equipment worth thousands of dollars.

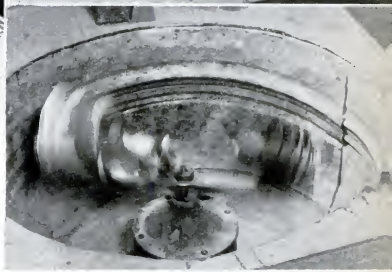


1 To make a ring, a working mold is formed around a master pattern hand-executed in a silver-copper alloy. The mold is made of a soft, low-fusing metal in a number of interlocking pieces, shown above being assembled. Hot wax is then injected into the closed mold and allowed to solidify, after which the pieces of the mold are carefully taken apart (above). The wax pattern thus made, held in the operator's right hand, is an almost perfect copy of the original master pattern. In the lost-wax method, a wax pattern must be made for each individual cast piece, since it's destroyed in the process of making the mold in which the piece is cast.

How Rings Are Made

PS PHOTOS BY HUBERT LUCKETT

2 Now the pattern in wax must be converted into precious metal. A "fan" of wax patterns (foreground) is stemmed into a clay base. In background air is sucked out of a quick-setting plaster compound under an evacuated bell jar to prevent bubbles in the plaster. Then a metal flask is fitted around the fan and plaster is poured in. It is then put into a gas oven for four hours at temperatures up to 1,300° F., where the wax patterns melt, run out of the mold, and evaporate (hence the "lost" in name). The plaster remains with cavities exactly the shape of original pattern. Inspection during manufacture is strict. At the Bardach factory, where these pictures were taken, 18 percent of all finished rings are rejected as imperfect.



3 The plaster mold is now put into centrifuge and molten gold poured into reservoir at its base. Throat of mold has been heated to prevent chilling metal. Then centrifuge is spun, slinging liquid gold into cavities in mold. The gold hardens quickly. Now to get it out.

THE rings you see encircling the finger of the bride or the '51 graduate are the products of one of man's oldest arts. The making of fine rings by the lost-wax method dates back 2,000 years. But the art was handed down from generation to generation until the monk Theophilus described it in a treatise written around the year 1100.

Modern application of this ancient technique for precision casting—used for a big proportion of all fine rings—is shown on this spread and the next page. Here the product is to be a man's ring set with topaz, made in the factory of Bardach Bros., of Indianapolis, oldest establishment of its kind in this country.

4 Digging the plaster away does it. This is what the gold casting looks like. "Gate," or stem on the base, is cut off at this point.

5 Lapping is the next step. An abrasive compound is used on this spinning wheel. It imparts a first polish. *[Turn the page.]*

6 **The engraving,** if any, is done at this point. A layout dye is first applied so engraver can make his guide lines without marring the metal surface. Above, an initial is being cut freehand in one side of the dyed ring.

7 **Vitreous enamel** is carefully laid in engraved grooves after ring has been "pickled" in sulphuric acid to clean surface. Three minutes of high heat fuse the colored enamel lines.

8 **Stoning** smooths enameled lines down flush.

9 **With a burr** that looks something like a dentist's tool, the seat cast in the top of the ring is trued up to receive the stone.

10 **Peening** the ring to hold the stone in place is the final, delicate operation.

11 **The finished ring** looks like this. Total time for manufacture: under six hours.

Phone-Linked Dictation Machine Serves 10 Desks

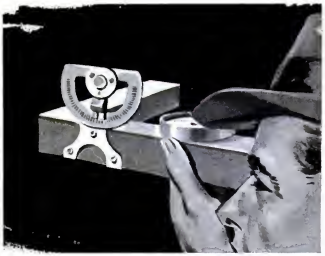
By crossing a dictation machine and a telephone system, this new device lets 10 people, scattered in different offices, use a single machine. To dictate, a person talks into a phonelike instrument (inset), pressing a button. This starts and stops a plastic disk on a recorder on the secretary's desk at a central point. Pressing another button plays it back. A light tells the user if the line is busy. When a disk is filled, a buzzer notifies the secretary to change it. She puts the disk on another machine for transcribing. Thomas A. Edison, Inc., devised the new system.

Hydraulic Digger Drives like Car

This new ditchdigger handles like a modern, no-shift car. Its hydraulic transmission requires no clutch or gearshift and gives an infinite number of speeds at the touch of a single control. This, combined with three bucket speeds, provides close control of its digging action to meet varying ground conditions. On the highway, the Runabout Ditcher can travel at 15 m.p.h. It is made by Barber-Greene, Aurora, Ill.

I'd like to see them make . . .

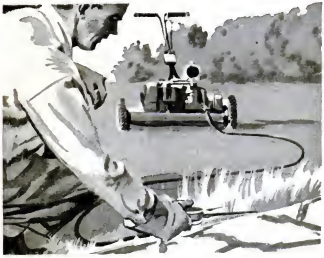
Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.



A surveyor's hand level with a floating-dial compass and rangefinder attached. A one-man outfit for taking compass sight, finding distance, and leveling. For mapping and coastal navigation.—*W. L. McAboy, Columbia City, Ore.*

A plastic-covered foam-rubber pad with harness. Could be easily slipped on and off by the home mechanic who has no crawler but occasionally wants to do some work underneath the car.—*Wayne Stanis, Cleveland.*

Small cardboard shakers for grated cheese, pepper, and other spices, made with a clear-plastic strip down the middle. The housewife then could tell when she needed replacements on such items.—*Betty Haak, Denver.*



Long-handled trimming cutter driven by a flexible shaft connected to power take-off on a home power mower. Grass around shrubs and along walks could be trimmed as soon as mowing is done.—*A. R. Godfrey, Spokane.*

A long-handled cooking spoon, hinged so that it would also form a ladle for deep pots. Such a cooking tool would be helpful for serving stews and other foods cooked in sauce or in gravy.—*George Perry, Stamford, Conn.*

Helicopter Charts Niagara River Bed

Bell helicopter hangs over lip of Niagara's Horseshoe Falls for first profiling of bed of turbulent river in history.

FOR the first time since the discovery of America, the bed of the Niagara river just above the famous falls has been surveyed. A helicopter made it possible when other ways of doing the job were considered or actually tried and abandoned as impossible or too costly.

In the past, the speed of the water as it rushed past Goat Island to crash over the 163-foot falls had thwarted every attempt engineers had made to get a profile of the river bed.

When the survey became necessary by the terms of a treaty with Canada last year, 30-inch balloons were first sailed over the water with a lead line attached. The current and winds fouled up the readings. Several other attempts, using balloons singly and in groups, also failed. An idea for erecting movable towers on the river banks with a cable strung between them proved to be too costly.

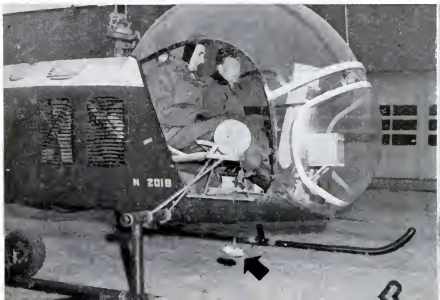
Boats, of course, were out of the question. No boat, even if tethered, could live in that turbulence.

Then Gordon Yesser, a civilian with the Army's Corps of Engineers, had a suggestion—why not try a helicopter?

It worked. Hanging motionless above the river, the helicopter would take a sounding. Then, to avoid reeling in the wire each time, it would rise until the weight cleared the water, fly 300 feet to the next location, and float down until weight touched bottom.

The survey was necessary under the treaty to determine how much water could be diverted from the river for power purposes without destroying the beauty of the falls. The information gleaned will be incorporated in the construction of a 400-foot model of the river's profile covering 88 miles of shoreline. Above the turbulent stretch of water the survey was conducted by customary methods. END

Soundings were taken with lead weight (arrow, below) attached to 2,000 ft. of piano wire on reel. Bell Aircraft Corp. helped in survey. Pilots are Dick Stansbury (left) and Bill Quinlan. After weight reached bottom, helicopter held hovering position (right, below) until surveyors at four points ashore trained transits on target. Marks on wire told depth.



Golfer Keeps Going After Dark with Portable Floodlights

THE black of night doesn't prevent Jim Walker, of Portland, Oregon, from enjoying his favorite game. He built a self-contained mobile power source to floodlight the greens and fairways. As shown at right above, the unit rides on three balloon tires and is mounted on a tubular frame of aluminum and steel. The single-cylinder 2-hp. gasoline engine drives a generator that powers a lamp of 600,000 candlepower. As a ball is hit, an assistant switches from floodlight to spotlight to follow its flight up to 250 yards.

Rubber Grasshopper Fools Fish

FRESH-WATER fish are said to bite greedily at the lifelike grasshopper at right, but all they get is a mouthful of latex rubber. Molded by hand, the lures are packaged in individual transparent Tenite containers for protection. They're made by Nature Faker Lures, Inc., Windsor, Mo.

Pumper-Plow Combination Fights Fires Two Ways

THE special one-ton, four-wheel-drive truck below, a cross between a fire-pumper and a plow, tackles forest fires with a one-two punch. The plow, operated by a hydraulic lift, rips up the ground to create a fireblock around the edge of a blazing area. A pumper pours water from a 100-gallon tank to quench the flames. A powerful winch on the front end pulls tree stumps and disabled vehicles out of the way. The Pennsylvania Dept. of Forests has 24 of these Willys firefighters.

Keeping the Home Shipshape

When you wash woodwork, put your equipment in a child's wagon and pull it along as you work. You'll have less stooping to reach pails. Newspapers in wagon bed absorb drips.

Flower boxes last longer if lined with galvanized iron, cut and bent to fit inside the box. Solder the seams if possible, or else coat them liberally with roofing compound.

Vacuum-bottle corks often "sour" when coffee or other liquids containing milk are carried. Wrapping the cork in aluminum foil will protect it from contact with such liquids.

To point up or trim old paintbrushes, dip the bristles in water-soluble glue. When they're hard, shape on a grinding wheel or sanding disk. Soak out the glue with warm water.

Cut-down milk cartons will hold water for the children's water-color painting. The cartons have a broad base, so they do not tip easily. Notch the tops to hold extra brushes.

Please turn the page for five more suggestions.

Keeping the Home Shipshape

When mending the fingertips of gloves, slip a thimble or a lipstick case into the worn finger. This makes it easy to get at the hole or worn spot to do a neat job of mending.

A discarded percolator is a handy container for used fats. The coffee basket strains the drippings and it's easy to reheat the fat and pour it when you want to use it again.

When frying sausages, fasten three or four together with metal skewers. Then you can turn them like pancakes. This saves time and makes them more manageable.

Wedge small nails or tacks between the teeth of an old comb for easy hammering. Use the comb to hold the nails in place until started, then remove comb and drive nails home.

Cotton flannel, sprayed with liquid furniture polish, makes an ideal dusting cloth. Hang the flannel on the clothesline and spray with polish. Store the cloths in covered cans.

PS reporter Devon Francis flies plane with new Lear autopilot as inventor watches from right seat. Plane climbs, glides, and banks in response to turning of two knobs on tiny controller unit (right) mounted in cockpit in front of instrument panel.

New Autopilots Matched to Jet-Fighter Speed

Two new devices, designed for high speed and cramped cockpits, will enable jet jockeys to fly "no hands."

By Devon Francis

THE fighter-plane jet jockey, that breed of airman who has become so prominent in the U. S. armed forces since the war, is about to fly "no hands" for the first time.

Two new automatic pilots, specifically designed for the high speed and cramped interiors of jet fighter planes, are going to be installed in the newest of the interceptors coming off the production lines.

One is the Lear autopilot. Designed by William P. Lear, the brilliant aviation engineer who is constructing the world's first television-directed laboratory for military aircraft (PS, Mar. '51, p. 144), it weighs less than 55 pounds complete.

The other autopilot, made by the Westinghouse Electric Corp., is described as the first automatic pilot with unlimited maneuverability. Developed at Wright-Patterson Air Force Base in Ohio, it has three non-

Lear (left) and Francis easily hold all components of lightweight autopilot. Two gyroscopes are used to correct plane movements around its three axes—pitch, roll, and turn.

tumbling gyroscopes that will operate through any maneuver of an airplane—such as a loop or a roll.

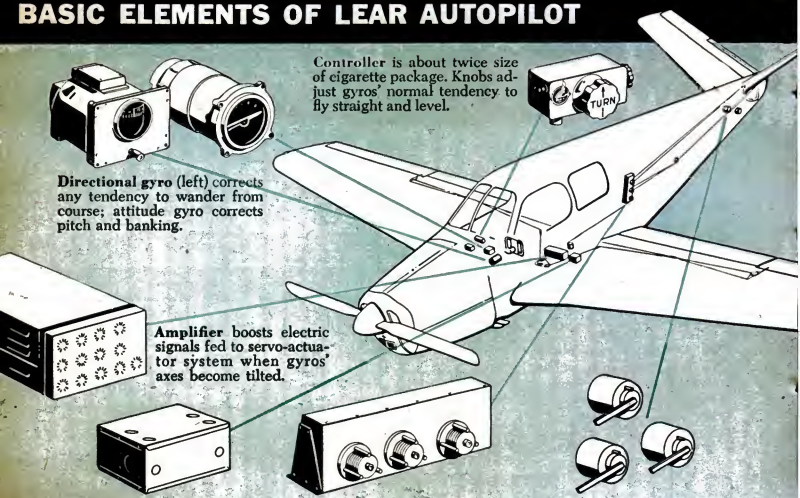
Gyros in previous autopilots "tumbled" in extreme flight attitudes—they lost their ability to sense a departure from normal flight.

Details of the Westinghouse autopilot have not been made public.

The Lear autopilot, however, is an outgrowth of a device originally developed for light sport planes, the details of which are known. It will do more than fly an airplane from here to there. With the use of a "coupler," it can be buttoned to the two beams of the Instrument Landing System (ILS) to bring a plane down in thick weather to within a few feet of the surface of a runway.

It is the sensitivity and light weight of both autopilots that set them apart from other automatic piloting devices. The sensitivity in the Lear is a direct product of the development of a new servo actuator—the

BASIC ELEMENTS OF LEAR AUTOPILOT



Controller is about twice size of cigarette package. Knobs adjust gyros' normal tendency to fly straight and level.

Directional gyro (left) corrects any tendency to wander from course; attitude gyro corrects pitch and banking.

Amplifier boosts electric signals fed to servo-actuator system when gyros' axes become tilted.

Dynamotor is power source for three servo actuators. Like all other components, it is miniaturized to save weight.

Magnetic-clutch servo actuators do all the work through cables connected to two ailerons, rudder, and elevator.

Follow-ups prevent over-controlling by autopilot. Installation shown here is in a Beech Bonanza lightplane.

"muscle" of the automatic control system. It uses dry-type magnetic-powder clutches (a refinement of the magnetic-liquid clutch described in PS, June '48, p. 83).

All autopilots have two basic components. One senses a change in the attitude of the airplane—as when a wing goes down in rough air. This sensor is a group of gyroscopes that fight any effort to tip the axes on which they are rotating. This reluctance to tip is translated into an effort to compensate for the change in the plane's attitude—a movement of the controls to correct the position of the wing that has gone down. The ailerons move, and the wing comes up.

The ailerons are moved by the second basic component of the system—a motor and cables to move the control surfaces.

Previous autopilots used big, comparatively high-inertia motors and drives that were started and stopped each time a movement of a control was required. The starting required time. The wing was slow to come up. The stopping required time, too, and the autopilot sometimes overcompensated. The wing overshot a level position and oscillated several times, back and forth, before it came to rest.

Overcomes Tendency to Overshoot

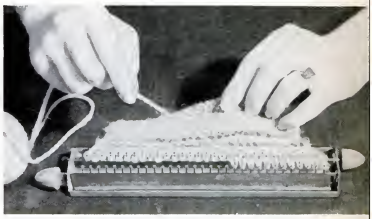
Lear's servo actuator uses a small, high-speed motor that runs continuously. The output shaft is geared to two differentially mounted magnetic-powder clutches. They, in turn, drive the actuator output shaft. All the spinning members on the output, or start-stop side of the unit, have low-inertia characteristics. The high-inertia members are on the input, or continuously rotating, side. The magnetic-powder clutches control the amount of torque, or twist, imparted to the output shaft because they respond instantaneously to the amount of current applied to their coils.

The lag between a sensor's recognition that a wing ought to be restored to a level position, and the actual movement of the controls, is cut to a fraction of a second. Additional circuits, acting as correction circuits, prevent the system from overshooting.

So impressed is the Air Force with the two new autopilots that Lear, Inc., at Grand Rapids, Mich., and Westinghouse, at Pittsburgh, have been given multimillion dollar contracts to produce them. They will let a pilot sit back and relax on his way to and from combat instead of constantly riding the controls. END

Tree Yields 500 Feet of Lumber

A RECENT forestry exhibit at the Columbia County fair grounds in Oregon showed visitors that a 50-year-old Douglas fir gives 500 feet of lumber. All parts of the tree, from the 15-inch-diameter stump to the slabs, or rough outside pieces, were laid out in the tree's relative growing position, as shown above.



Machine Makes Stitches Faster

WITH this rakelike hand knitting machine, the operator can make several stitches with a single movement instead of each one individually. Before casting, the yarn is wound around the pins in zigzag fashion, as above. Ainslie Knitting Machine Co., of Brooklyn, N. Y., makes the eight-inch steel device.

Aids to Modern Living

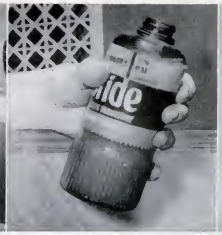
Cooker Is Automatic. This combination pressure cooker and electric hot plate with cooking timer eliminates the watching that ordinarily goes with pressure cooking. Placed on the stove, the pan is pushed back until the pressure-control valve in its lid slides into a slot under the timer. Then the pressure gauge and timer dial are set. When the desired pressure is reached, a pin in the pressure valve engages the clock mechanism. At the end of the cooking period, the timer shuts the current off and the pressure is automatically exhausted from the pan. Proctor Electric Co., Philadelphia, prices the AC Presurmat at about $40. It also serves as a hot plate, independent of the timer.

Tube Dispenses Oil. When a plunger at the end of this dispenser is pressed, the tip oozes oil a drop at a time. A cap protects it when not in use. Malko-Wortell, Inc., Chicago, makes it to sell for $1.

Opener Slices Lids. When its knifelike blade has pierced the lid, this German can opener steers around the rim of the heaviest can. Sold by Hoffritz, N.Y.C., for $1.75.

Brush Saves Back. This long-handled, foam-rubber brush saves some of the back-breaking work of scrubbing the bathtub. Available from Miles Kimball Co., of Oshkosh, Wis., it costs $2.25.

Pad Eases Eye Strain. Made of Vinylite, this eye-pad mask has a sealed-in chemical solution that retains heat or cold up to 45 minutes. Sold by Schaefer Berget Corp., N.Y.C., for $1.50.



Wax Is Easy to Apply. Spread Pride on furniture, let it dry, wipe lightly. You'll have a rich, long-lasting luster that's hard and dry. It's the furniture version of Car-Plate.

Vacuum Dries Hair. Attach a home vacuum that blows air to this plastic cap, and it will dry hair at home in 30 minutes. Made by American Textile Products Corp., St. Louis, to sell for $1.

Cabinets Cater to Woman's Reach. The top shelves of these General Electric kitchen cabinets have been brought within reach of the average housewife. Counterbalanced doors lift up from the bottom, out of the way. Space lost in lowering the units is regained with "underwall" cabinets.

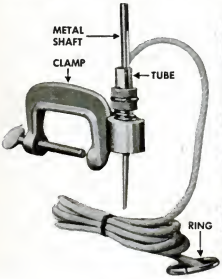
Cranking Device Mixes Paint. Turn the crank, and a perforated paddle, seen through cutaway in can above, mixes paint thoroughly right down to the bottom of the can. THORO-Mixer, made by the Standard Churn Co., of Wapakoneta, Ohio, comes in sizes to fit gallon and five-gallon cans.

Treated Cloth Hates Water. When treated with a new silicone water repellent, De-Cetex 104, even the wide-meshed material below makes water gather in globules that can be brushed off. A product of Dow Corning Corp., it is being applied to fine fabrics for women's rainwear.

Fir Trees Wear Girdles

TREE farmers in Centralia, Wash., put steel bands around the trunks of superior quality Douglas firs, as at left, to stimulate seed production. When a tree's girth increases, pressure caused by the tightening belt is said to "frighten" the tree into thinking it is dying. It then begins to divert food energy to the growth of seeds. This theory was developed when it was noticed that trees injured by the clawing of animals were stimulated to generate more seeds. The reforestation experiment is being conducted by the Weyerhaeuser Timber Co. on about 100 of their trees.

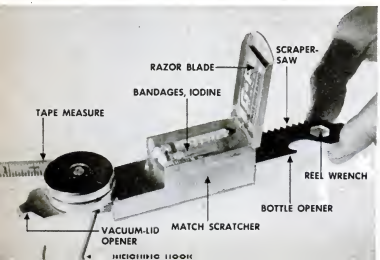
Clamp Secures Fish Stringer, Suction Cups Hold Poles to Car



WITH the aluminum-alloy clamp device at left above fastened to the side of your boat, you needn't worry about losing that string of fish. The metal spear end of the fish stringer fits into a tube attached to the outer side of the clamp. Because of a tapered slot, the harder the pull on the stringer, the more firmly it holds.

Another fisherman's aid is the carrier shown at right above. Fish poles are held in clips that attach to the top of the car by single or twin suction cups. A drawstring is provided to tie one or more poles to the clips. The units, which also can be fastened to fenders or windows, have been used to carry skis and lengths of pipe. Both items are made by Brehm's Novelty Mfg. Co., of Racine, Wis.

Jack-of-all-Trades Gadget Fits in Outdoorsman's Pocket



SIXTEEN tools handy for the fisherman, hunter, or Boy Scout are built into the pocket-size Jiffy Pal shown at left. The steel measuring tape is three ft. long, and the scale will weigh up to 10 lb. A combination tweezers and knife slides into a slot on one side of the box. At far right, hidden by the fingers, is a combination fishhook disgorger and screwdriver. Jiffy Specialty Mfg. Co., Fort Worth, Tex., makes it.

MECHANICS
and
HANDICRAFT
REG. U. S. PAT. OFF.

This pine suntan chair was a wreck. A wheel was missing, joints were loose, and the ropes were broken. But if repaired, it could be used many more years.

How to Mend Lawn Chairs

After it was overhauled, the old chair shown above looked like this. Turn the page to see what had to be done to it.

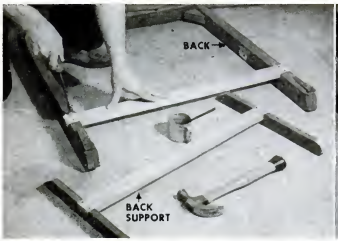
Overhaul them now and relax this summer. Anyone handy with tools can do it.

By Paul Corey

THE old gray chair that you dozed in outdoors last summer may not look quite so inviting when you haul it out this spring. Weather and people alike are rough on lawn furniture, whether it is made of wood, canvas, or metal.

But lawn furniture is easy to repair. I have just finished overhauling mine and my neighbor's. It's as good as new again now, and POPULAR SCIENCE has asked me to show you what I did. Maybe your battered-up chairs can be salvaged the same way.

Here's how the suntan chair was put in tiptop shape.



Crossrail of back support was cracked, so I replaced it with a wider piece that I notched into the two vertical pieces. I removed the adjustable back and strengthened it (above) by letting a similar crosspiece into the frame. These crosspieces were fastened with screws and glue. The corner joints were beefed up with 2½" No. 10 screws. The bed frame, too, was wobbly. So I replaced the old wooden corner braces with ¾" by 4" flat angle braces (above). This is a good way to strengthen any wooden angle joint. Such straps are available for mounting on the surface or inside the angle, but should be screwed—not nailed—to wood.

Missing wheel was replaced by a new one. I removed the good wheel and used it as a pattern on a square of two-by-twelve. With my handsaw, I made a series of cuts around the circle. Then I put the new wheel in a vise (left) and rasped it until it was round. You can make a stronger wheel out of ¾" plywood, but for outdoor use you should use exterior-grade plywood.

Old rope webbing was replaced (right) by plastic clothesline after the chair had been given two coats of implement enamel. This sturdy line doesn't sag as much as rope. It stays white and can be cleaned with a damp cloth. A 100′ hank was enough for this chair.

Metal supports sometimes give way, too.

Metal straps and spiral springs support the cushion in some lounge chairs. The hook of a spring had pulled out of the end of a strap, letting the cushion of this one sag. I removed the strap and rounded the pulled-out end with tin snips. Then I placed the end on a block (right) and with a nail set punched a new hole for the spring hook. Now the chair is like new.

New canvas and fresh paint recondition deck chairs.

Canvas deck chairs are standard items of lawn furniture. And their condition, after a few seasons, is also standard—torn canvas, split or cracked rails, and peeling paint. I removed the old canvas (right) and used it as a pattern to cut new canvas. (Be sure to give yourself more length than the pattern calls for.) Broken and split rails were replaced with 1" ash dowel. Then I scraped off the old paint, sanded the frame of the chair, and gave it two coats of implement enamel.

New canvas is easy to put on. It's just tacked in place. I turned this chair over and rested the front rail of the seat on my workbench. The end of the canvas was folded as if I were going to make a hem. I tacked right through this fold (left) and into the rail, putting a tack each inch. Then I turned the chair upright and wrapped the canvas around the rail once before I brought it up to the top rail. With the chair folded, I rested the top rail on the bench. I pulled the slack canvas around the rail so I could tack the folded end to the back of the rail (right). Someone may have to hold up the loose canvas while you do the tacking. When put on the backs and undersides of the rails like this, the tack heads do not show.

A simple fix takes slatted chairs off the casualty list.

Broken seat slats are one of the commonest ailments of slatted outdoor chairs (left). I first thought I could remove the broken slats from this chair and replace them with new ones. Then I discovered that the slat ends were held in slots in the frame by small brads. After working for an hour trying to remove the brads, I concluded that I would wreck the seat frame by the time I had dug them out. I then tried to mend the slats with glue, but this was not satisfactory. So I went to a local cabinet shop and got a scrap of hard composition board large enough to cover all the slats. I bored holes through the board at points where they would be over gaps between the slats. I smeared glue on the tops of the slats, pressed the board down on them (right), and held it there with sandbags until the glue had set.

When wicker furniture breaks down, here's what to do.

Wicker furniture's usual ailments are loose joints and unwound rattan. The rung of this chair, held by a slim nail, had pulled loose. I removed the nail and put in a screw (left) to give the joint a better grip. After smearing rung and brace with glue, I rewound the rattan (right) and held it with tape until the glue had set.

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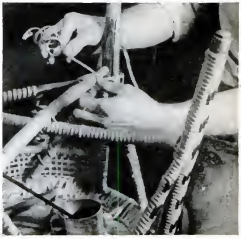


Dowels and screws repair breaks in tubular furniture.

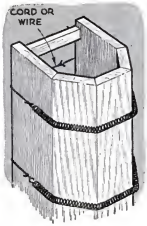
Metal tubing of outdoor furniture sometimes breaks where holes have been drilled for bolted joints. To fix it, I use an ash dowel that fits snugly inside the tubing (above). Then I drill a hole on each side of the break and insert small screws through the metal and into the wood. A new bolt hole is bored through the dowel, and the chair is strong and sturdy again.

Folds in cushions like this one (left) are fine places to catch dust and dirt. I even found wads of kids' bubble gum stuck down in these folds. A whisk broom brushed out the dust and dirt and benzene removed the gum. Finally, I used our vacuum cleaner on the cushion.

Repainting canvas cushion covers is impractical unless the material is in very good condition. You'll save in the long run by replacing the canvas. However, with a complicated cushion like this one (right), repainting seemed advisable. I found that the easiest way was to remove the cushion and hang it up. Canvas paint was used, topped off by the "overcoat" that is sold with it.

Here we are with our reconditioned lawn furniture—ready for another season in the sun.

Screen-Door Springs Used as Clamps



Did you ever try to glue up a column or half column without suitable clamps? This can be an annoying problem, but I've found one simple solution. Use screen-door springs and tie them around the work as in the drawing.—*Howard E. Moody, Upper Jay, N.Y.*

Handhold Makes High Work Safer

To avoid grabbing thin air when working on ceilings and high walls, I added a detachable balancing pipe to my stepladder. A small box mounted on a floor flange on top of the pipe also provides a handy place to put a paint can or tools.

The upright is held by a pipe clamp permanently screwed to the top of the ladder. (There is one at each side.) A pin or rivet through the ¾″ pipe rests on this upper clamp, keeping the pipe from dropping through. The lower end is secured to another pipe clamp on a strap-iron brace—hardwood would also do—that bridges the legs of the ladder. To make the brace easily removable, I notched one end to hook over a screw and drilled the other for a bolt and nut.—*O. C. Grant, Springfield, Mass.*

Hangers Simplify Window Storage

Storm windows should be kept off the floor when stored to prevent warping. I solved the problem neatly and without the necessity of building racks, by hanging them vertically on strong hooks screwed into an overhead beam in the basement.

To form hangers, I cut the crossbars of stiff-wire coat hangers with wire snippers, bent the ends up, and closed the hooks tightly to make eyes. A rope or tape passed around the windows and fixed to the wall stops rattles.—*B. L. Sauter, Wheaton, Ill.*

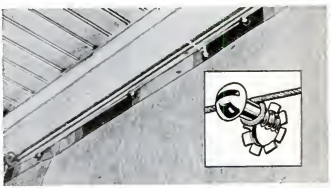
Clamp Thin Wood for Drilling

When you have to drill a thin piece of wood, protect it with a pair of pads and a C clamp, as shown in the photo at right. This will help keep the wood from splitting as the drill penetrates it.

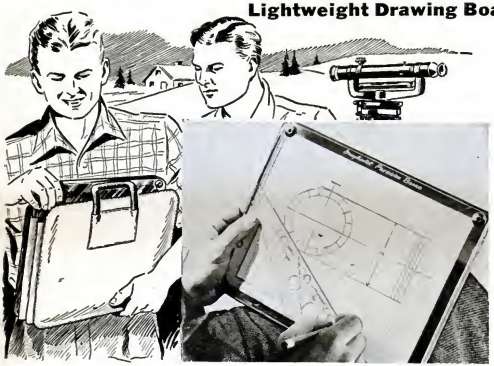
Eyelets in Awnings Are Fastened Quickly With Wood Screws and Cord

Awnings that have eyelets can be put up or taken down quicker if screws are used.

Insert a roundheaded brass screw at each point where an eyelet will be. Let about ½″ of the screw project from the wood. Hang the awning by slipping the eyelets over the screws. Tie a retaining cord to one of the end screws. Run the cord to the other screws, looping it around each one. Finally, tie it to the other end screw.



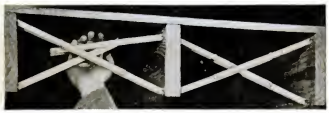
Lightweight Drawing Board Fits Briefcase



A NEW drawing board, weighing less than eight ounces, is made of transparent plastic. Recessed spring clamps in the corners grip 8½"x11" paper, eliminating tacks. Two retractable metal straightedges serve as a T-square, and tension clamps on the underside of the board keep triangles handy. Made by the A. Partrick Co., Westwood, N. J., the board sells for about $4.

Floor Bridging Needs No Nailing

THIS new metal bridging for bracing floor joists in homes requires no nailing. Sharp points on each end of the steel supports bite into the joists as the two pieces snap-lock together when pulled down. The maker,



Glover Mfg. & Sales Co., Akron, Ohio, claims that unskilled labor can install as many as 38 pairs of bridging in a half hour at a cost of about 30 cents a pair, and recommends them both for new home construction and for stiffening old floors.

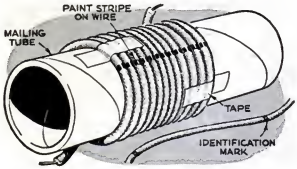
Strap Hinge Prevents Reflector Sag

A SMALL strap hinge is a handy photographer's aid. You can use it as shown below to lock a reflector to a lamp stand.—*Arthur Trauffer, McClelland, Iowa.*

How to Code Electric Wires

IN RADIO or electrical work you often have to twist or cable separate wires and still be able to identify each one. Instead of keeping a large assortment of colored wires on hand you can code wires as shown in the sketch below.

Wrap a length of wire around a mailing tube and paint a stripe along the coil with



nail polish, grease pencil, or ordinary paint. (Use paint or polish sparingly as their solvents affect some types of insulation.) When the wire is unwound it will have a series of identifying dots along its length. By painting stripes of different colors you can code as many different wires as you need.—*Frank Shore, Manhattan, N.Y.*

Glue and Paint Hide Plywood Edges

WHEN a plywood edge is to be painted or enameled, first coat it with glue. Mix some casein glue and paint the edge with one or two coats—two coats is better. After the glue dries, sand it smooth. Then paint it.—*Vernon Thurman, Elgin, Ill.*

This tree pocket extends 24" below the concrete terrace and is fenced around by four triangular plant boxes that make up a single unit. Box bottoms are drilled for drainage.

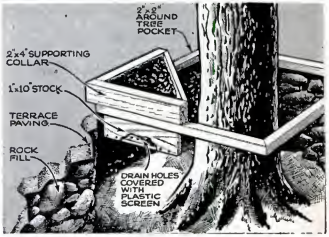
Each corner box can be lifted out separately. Boxes are made from 1" by 10" redwood and have two-by-four collars by which they're suspended in pit. Joints are fastened with screws.

Flower Boxes Guard Pocket Left Around Tree

When the space around a tree has to be filled—as it had to be for the concrete terrace shown here—the earth or rock fill must not bury the base of the tree. The pocket around the tree should go down to the original ground line and be large enough to allow for tree growth.

To keep people and pets from falling in, tree pockets are usually encircled by walls of brick, rock, or concrete. In addition, such pockets are sometimes covered over by metal grids.

The removable plant boxes illustrated here act as both fence and cover. In appearance they're completely in harmony with the terrace and the trees.—*Bob Gilmore, Boyes Hot Springs, Calif.*



Adapter Speeds Drain Cleaning

Water pressure will often clean clogged drains, but it is hard to maintain adequate pressure when you simply put a hose in the drain and stuff rags around it. A hose adapter makes the job easier. I made the one shown by drilling a hole in a small square of galvanized iron and soldering the square over a section of standard drain pipe. I pressed a hose fitting into the hole and soldered it fast. To make the adapter pressure-tight, I wedge it into a drain with a piece of cork gasket material wrapped around it.—*Stewart Becker, Tucson, Arizona.*

Irons Make Campfire Cooking Easy

These campfire irons are made from ½" black iron rod, shaped by heating in a small forge. The ends are pointed so that they may be easily forced into the ground. Raising or lowering the irons controls the cooking temperature.

Why Shacks Come Apart

Vacation places cost more when built on a dubious foundation.

Corner of building that is sustained largely by faith (right). The rock is set on top soil and is subject to heaving by frost action. Rock will heave, post will tilt, and house will sag.

By R. L. Clough, Jr.

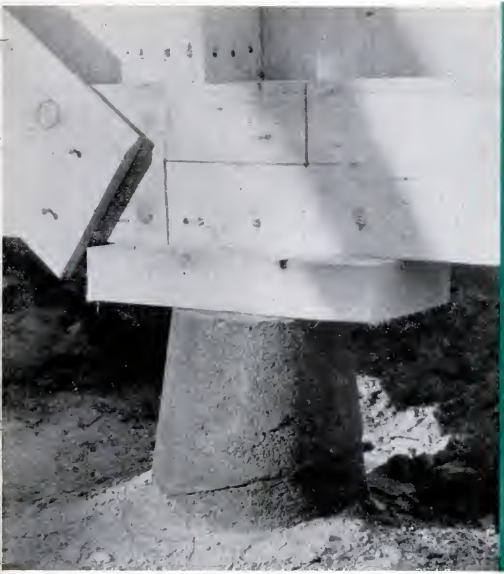
BEFORE you buy "an inexpensive little vacation place," put on your dungarees and see what holds it up—especially if it is in the North country.

Most summer places are built with an eye to keeping construction costs down. And to some people the foundation looks like a good place to skimp on costs. But it isn't. The damage that can result from a poor foundation can cost you a lot of money.

A concrete-block foundation that will last for years in Florida or southern Texas isn't

Repeated foundation repairs can be seen here —old mushroom piers that have had to be dug out, the discarded posts, and the dangling switch box. Makeshift repairs like this can go on indefinitely—or until job is re-done properly.

Foundation troubles often show up here. Note how chimney has stayed put while the house slid away from it. Besides pulling away from the chimney, the tilting foundation also has caused the siding to pull apart.



Good foundation is a simple cone pier (left). This is also a good way to splice and support a sill. Drawing above shows how to make a form out of building paper for such a cone pier.

likely to last long in Maine. Freezes followed by thaws and more freezes are rough on foundations.

The sills of many summer places are supported by piers rather than poured or laid-up foundations. Piers are all right if they are properly installed.

Piers set on top of the ground, however, can cause trouble. So can those that are not set deep enough. When the first cold spell comes, the ground freezes. Then comes a thaw. Water soaks into the ground, particularly around the piers where the earth has been disturbed. Comes another freeze and the water freezes and heaves and pushes. It exerts tremendous pressure against the piers. Water gets under a pier. More freezes follow and the expanding frozen water tilts the pier.

When this happens, the sill that the pier was supporting starts to settle. And you have trouble in other parts of the shack. Floors slope, doors stick or won't close, windows stick, the chimney cracks, the house pulls away from the chimney, siding spreads, flashing pulls loose, and sinks won't drain because water runs to the wrong end. This freeze-thaw cycle may do its dirty work in one to four years.

Correctly designed piers that are set deeply enough are the answer. The pier should be in the shape of a truncated cone, and the hole for it should be dug below the frost line. Then the expansive force of freezing will tend to press the base of the pier more firmly downward.

A form for a cone pier is not difficult to make. Wind building paper into a cone and trim top and bottom evenly. Hold the cone in shape with heavy cord. Nails will keep the cord from riding up.

Place the cone in the hole and fill it with concrete. After the concrete has set, you can peel off the paper. Fill up the space around the pier with soil dug out below the loam level. Tamp it well. Don't use topsoil. Crown the dirt around the pier to help surface drainage. END

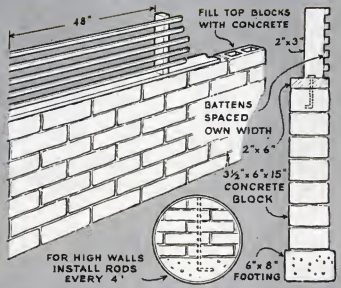
Fences Make Homes Look Well-Dressed

Make a fence part of your home, not just a keep-off-the-grass barrier.

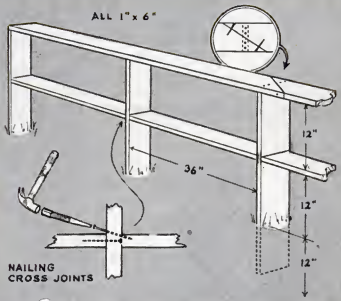
By Hi Sibley

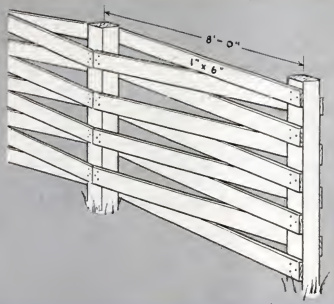
A FENCE is to a home what a frame is to a picture. Designed and built right, a fence will set off your home from other nearby houses. These pictures show a few of the many fences that contribute to the glamour of housing in Southern California.

Horizontal slats relieve the monotony of a concrete-block wall and also serve as a trellis for vines. A concrete footing under the wall is advisable. For walls over 6′ high, reinforcing rods are recommended.

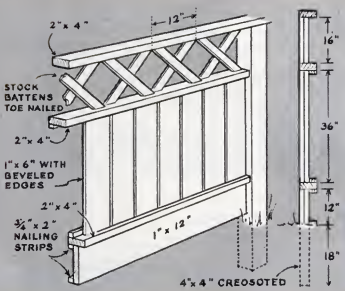


Flat rails form an interesting fence. This type of fence should be assembled in sections before putting the posts in the ground. You'll find it is easier to nail the sections together if you build it that way.

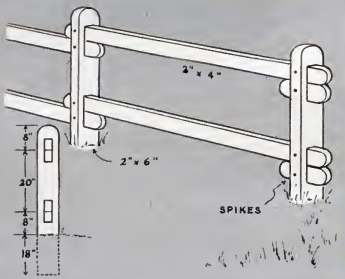




Crisscross board fence insures privacy for this home, and at the same time avoids the barren look of a plain board fence.

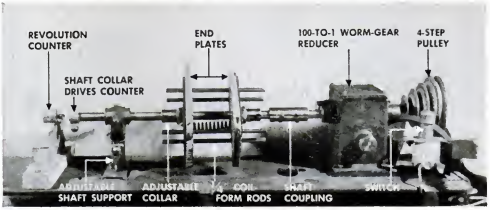


X-shaped lattice along the top adds pleasing effect to otherwise plain fence. Vertical boards are redwood and have V joints.



Over-and-under rails are an unusual variation of the old rail fence. Posts are 2" by 6", slotted to take two-by-fours.

Homemade Unit Simplifies Winding Electrical Coils



HAVING frequent occasion to wind coils for transformers, motors, and similar electrical equipment, I built this accurate coil winder from a few special parts and a handful of shop scrap. It will make coils from any wire up to No. 8 gauge.

Chief item in the setup is the 100-to-1 worm-gear reducer that is driven by a ¾-hp. motor through a four-step V-belt pulley. The adjustable coil-forming plates are fastened to collars that can be locked on the shaft with setscrews. The plates are provided with holes to receive ¼" cross rods. A collar at the end of the shaft operates a counter that keeps track of the number of turns. An auto-headlight dimmer switch controls the motor.—*Ray Millholland, Indianapolis, Ind.*

My Most Ingenious Solution

Night fishing is a lot of fun—if you catch fish. That was my trouble—lots of night fishing but no fish until I hit on this idea:

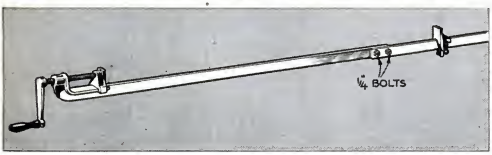
I tied a pencil-type flashlight near the end of my pole. The light shining down into the water attracted the fish and my bait got prompt attention. But don't do it unless night fishing with lights is legal in your state.—John Krill, North Lima, Ohio.

Touching up Metal Furniture

WHEN the enamel finish on metal outdoor furniture chips, rust takes over fast. Chipped spots should be resurfaced immediately.

The first step is to scrape off all loose enamel in and around the chipped area. With a square of emery cloth, feather the edges of the enamel down to the metal (right) and remove all rust. Prime the spot with red lead and, when dry, coat it with a matching outdoor enamel. Clear lacquer will also hold off rust temporarily.

Bar Clamps Bolted Together to Hold Extra-Long Work



WHEN you need extra-long bar clamps, bolt two of them together as shown. Bore matching ¼" holes and use ¼" bolts. — *John G. Straub, Shaker Heights, Ohio.*

It's Power Mower Check-Up Time

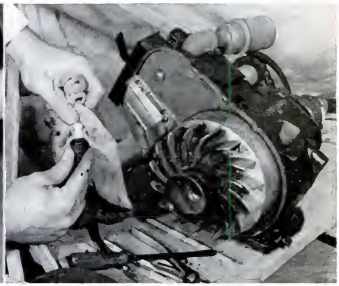
Tended properly after a winter rest, it will serve you better and longer.

By Thomas W. Helm III

AN HOUR spent now on your power lawn mower may save you both time and money later on. Begin by giving it a thorough wipe-down. Sharpen the blades and cutter bar, or have the job done if you don't feel up to it. Clean last year's dust and dirt from the air-cooling system.

Hard starting and poor operation may come from a gummed-up fuel tank, frayed ignition wire, dirty spark plugs, or badly adjusted carburetor. Check these carefully. The photos suggest other steps.

Drain oil, flush out with kerosene, and refill with fresh oil. Remove oil filter and gas tank, and wash with unleaded gas. Install new gaskets on filter and gas tank if old ones are torn.



Wipe spark plug clean. Using a feeler gauge, check the points to see that they are gapped to manufacturer's recommendations. Install a new plug if the porcelain is cracked.

Ignition wire must be well shielded. Tape any breaks with waterproof tape. Wipe wire from one end to the other, and scrape the terminals.

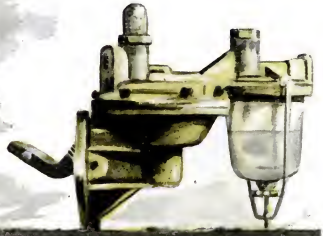
Remove wheels and lubricate the gears. As a final step, go over entire machine, lubricating control linkage and tightening running gear.

"Notice anything peculiar about those three fuel pumps?" asked Gus. Stan and Mr. Kinkaid leaned over, looked, and then shook their heads.

Gus Teams Up with the Doctor

A midnight encounter results in an appendix operation for Doc Marvin and a ticklish engine diagnosis for Gus.

By Martin Bunn



DOC MARVIN was driving along at a fair clip. Gus Wilson, the owner of the Model Garage, was in the seat beside him. It was well past midnight and the two men were anxious to get home and into their beds. The two old cronies had spent the evening in the city at the fights.

Traffic was light—just an occasional car—so Doc was making good but cautious time. As he slowed for a curve, Gus noticed a car up ahead, parked off on the road's shoulder. Standing in the fan of light from the car's headlights was a man frantically waving his arms.

"Maybe we better stop and see what the trouble is," said Gus.

The Doc replied with pressure on the brakes that slowed his car to a stop less than a half-dozen yards beyond the man and the car.

"Need a hand?" Gus called as he opened the door and climbed out.

"Sure do," came the reply. "Been trying to flag down a car for a half hour, but you're the first folks who even as much as slowed."

By this time, both Doc Marvin and Gus Wilson were within a few feet of the man. He was elderly and his face was wreathed with anxiety.

"Trouble?" Gus asked.

"A heap. My wife and I have been touring. About three-quarters of an hour ago she was seized with violent cramps—just about doubled her up. I stepped on it to try to get to a doctor. Then my engine sputters and quits and won't start."

The Doc Takes Charge

"Where is your wife?" Doc Marvin asked, striding toward the car.

"She's huddled on the back . . ." But before the man could finish, Doc had opened one of the rear doors and was climbing in.

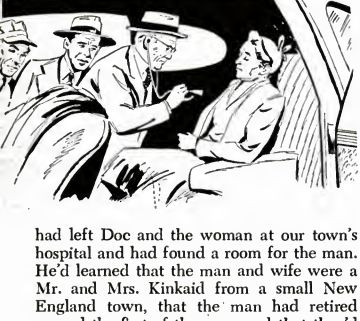
"Who's he?" the man asked, bewildered.

"A doctor, fortunately," replied Gus.

A moment later, Doc Marvin poked his head out through the open door. "Gus," he called, "give me a hand, will you? We've got to get this woman to a hospital right away."

When Gus and the Doc had made the woman as comfortable as possible on the rear seat of the Doc's car, Gus turned to the man. "Lock up the car and give me the keys. I'm a garageman. I'll come back here in the morning with my tow car."

It was well past three by the time Gus



had left Doc and the woman at our town's hospital and had found a room for the man. He'd learned that the man and wife were a Mr. and Mrs. Kinkaid from a small New England town, that the man had retired around the first of the year, and that they'd been off on a sight-seeing motor trip. However, it hadn't turned out to be a very pleasant one. Their 1942 car had plagued them with troubles almost from the start—and now Mrs. Kinkaid was ill. Well, thought Gus as he yawned and finally turned off his light, Doc Marvin will take good care of Mrs. Kinkaid.

Gus Gets Out the Wrecker

In spite of his lack of sleep, Gus opened the Model Garage on time the next morning. When Stan Hicks, his helper, arrived about 10 minutes later, he said, "Let's get going, Stan. Get into your work clothes; we've got a car to pick up with the wrecker about eight miles south on the state road."

"Smash-up?" asked Stan, pulling on his coveralls.

"Nope, just a stalled car," explained Gus as he climbed into the driver's seat. The wrecker's engine caught with a full-throated roar. "Luckily Doc Marvin and I happened by last night on our way home from the fights," he added as Stan climbed up beside him. "An elderly man with a sick wife and a stalled car. Doc took the wife right to the hospital."

When they reached the car, it didn't take Gus long to decide there was something wrong with the car's fuel system. Plenty of gas in the tank, but the carburetor wasn't getting any.

"No sense trying to troubleshoot it out here," he said as he closed the hood. "Rig up the tow gear and we'll haul her back to the shop."

"Might be a plugged gas line," offered Stan, as he fastened one end of the tow chain.

"Or a bum fuel pump," shrugged Gus, climbing back on the wrecker. "But let's not jump to conclusions."

When they got back to the garage with the car in tow, Mr. Kinkaid, looking a little less harassed and not quite so old as he had the night before, was waiting for them.

"Morning, Mr. Kinkaid," Gus called as he maneuvered the wrecker and car into the shop. "How is Mrs. Kinkaid?"

"We sure were a couple of lucky people when you two fellows came along last night. Doctor Marvin operated just as soon as he could after he got her to the hospital. Acute appendicitis!"

"How is she now?"

Operation Successful

"Doing fine. At least that's what the nurse at the hospital told me a short while ago. They're letting me see her this afternoon, so that sounds good."

"Great," grinned Gus. "Now, let's see what luck we can have with this ailing buggy. She been giving you a lot of trouble?"

"A heap of it," grumbled Kinkaid. "Over $100 worth in 500 miles, and she still won't perk as she should."

Gus let out a low whistle. "Well, at the moment," he said as he walked to the car and opened the hood, "I'd say she's got fuel problems—a fouled gas line or a bad fuel pump."

"Oh, don't say that, Mr. Wilson," groaned Kinkaid. "It just can't be. That's the third new fuel pump I've paid to have put on in the last five days. Maybe I'd best start at the beginning and tell you the whole story."

"Good," said Gus, thumbing shreds of tobacco into the bowl of his pipe.

It Began With a Timing Gear

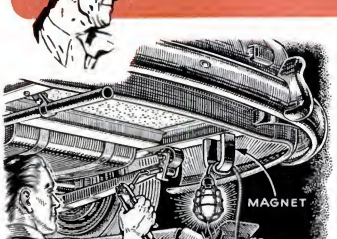
"Well, the first three days of the trip went smoothly enough," Kinkaid explained. "Then the trouble started in Virginia. The motor suddenly quit dead. After a 16-mile tow to a small garage, the trouble finally was laid to a stripped camshaft timing gear. After a lot of trouble, they finally installed a new gear. The car seemed to run fine, so we started off on our way again."

Gus nodded, puffing on his pipe.

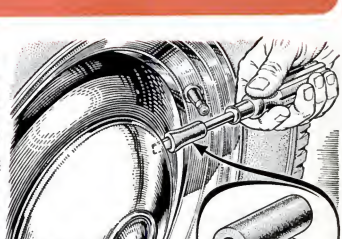
"But we hadn't gone 10 miles," continued Kinkaid, "before she stalled again and

[*Continued on page 242*]

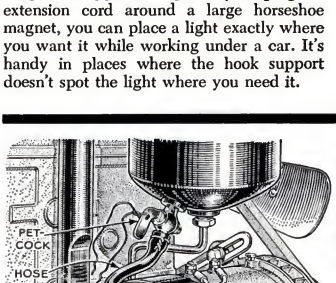
Hints from the Model Garage



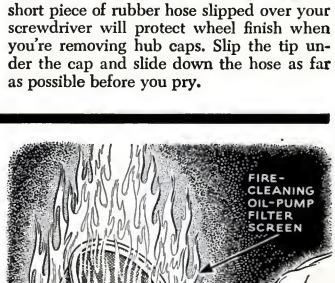
Magnet Supports Light. By looping an extension cord around a large horseshoe magnet, you can place a light exactly where you want it while working under a car. It's handy in places where the hook support doesn't spot the light where you need it.



Rubber Prevents Paint Scratches. A short piece of rubber hose slipped over your screwdriver will protect wheel finish when you're removing hub caps. Slip the tip under the cap and slide down the hose as far as possible before you pry.



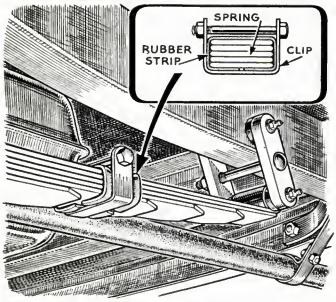
Hose Drains Oil Filter. Many oil filters have a plug at the base for draining out sludge and dirt. If the drainings would fall on engine accessories below, install a petcock like this and run a synthetic-rubber hose down far enough so the dirty oil will drop clear. Drill a hole in the petcock handle and use a wire to "safety" it.



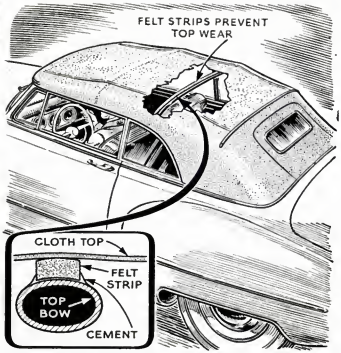
Fire Clears Stubborn Screens. Your oil-pump screen should be cleaned occasionally, even if you must drop the pan specifically for the purpose. If brush and gasoline won't do the job, put a match to the screen, let the sludge burn, and brush away the ash. This won't damage a screen unless it's soldered together.

Turn the page, please, for four more auto hints.

MORE Hints from the Model Garage

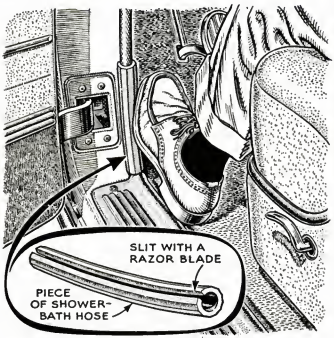


Rubber Stops Spring Squeaks. Strips of inner-tube rubber placed between a spring and its clips will often stop persistent metal-to-metal squeaks.

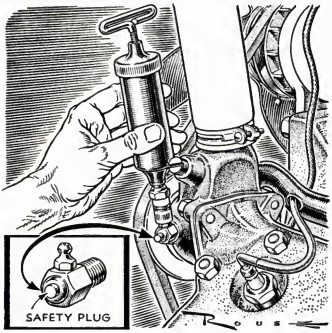


Felt Saves Convertible Top. At high speeds, a convertible top tends to slap the bows. In time, this may abrade or break the fabric fibers, making it necessary to put on a new top. To prevent such wear, Richard C. Schneeloch, of Tulsa, Okla., suggests cementing strips of felt on top of the bows. The felt will act as a buffer between the top and the metal bows when the fabric slaps down.

REPAIR TRICKS ARE WORTH MONEY. Anyone who works on a car may discover better methods of making repairs, or new ways of prolonging car life. Have YOU? *Popular Science* will pay for each hint published. Mail to the auto editor.

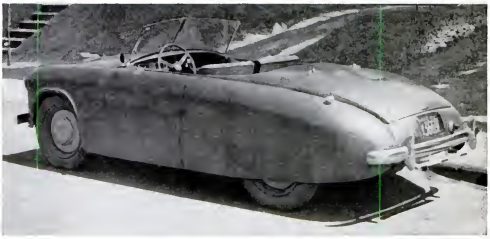


Slit Hose Protects Trim. On the interior of a car, one of the first points to show wear is the beaded trim at the doors. To repair such wear, or prevent it, slit a short piece of hose and slip it over the trim. The elasticity of the rubber will keep it in position.



Safety Fitting Protects Pump. On 1933-1936 Ford V8's, grease-gun pressure can damage the water pump. If yours is one of these cars, better take out the regular grease fitting and replace it with a safety fitting like that shown here.

Canadian Combines Parts of English Cars to Build His Own

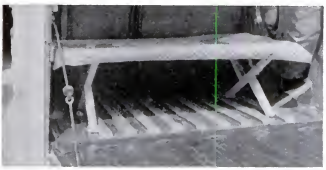


LIKE many other mechanics, J. R. Frizzle, of Ottawa, has definite ideas about what he likes in cars. So he built his own.

As a starting point, he used an engine and chassis from a 1949 Austin A40 half-ton truck, installing car springs at the rear. To keep the body low, he dropped the radiator and steering mechanism 3½" and lowered various accessories.

The body was designed around front fenders from a 1949 Hillman, another English car. The finished job has a 92" wheelbase, is 144" long, and stands 52" high.

Child Sleeps on Station-Wagon Cot



AN ARMY cot placed crosswise at the rear of a station wagon makes a fine place for a child to sleep when you are traveling. The cot must be shortened by cutting off one end and refitting the cross brace.—*Stanley R. Pennington, Rochester, Minn.*

Spring Keeps Socket Joint Stiff

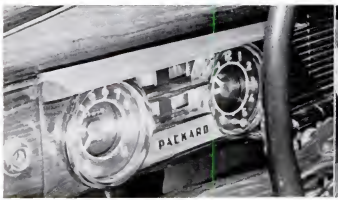
WHEN a universal-jointed socket wrench is being used in tight quarters, the socket sometimes tends to fall to one side. To prevent this, slip a light coil spring over the joint. The spring will give the joint freedom to bend but will keep it stiff while the socket is being seated on the nut.—*David Finlay, Brooklyn, N. Y.*

Awning Shields Instrument Panel from Light Reflections

THE narrow awning below reduces troublesome reflections from instrument-panel gauges in bright sunlight. It was made from a strip of sheet aluminum, covered on top with brown upholstering material.

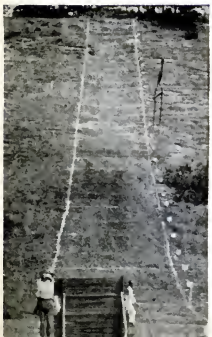
Tabs were bent down at each end of the metal strip. The front edge was covered on each side with adhesive tape, and the edge pressed into a slot above the instrument panel. This keeps the awning in place.

Non-reflecting material, as shown below, was cemented on top. An upturned lip on the outer edge retains pencils and other objects.—*W. Burton, Akron, Ohio.*



How Hill Climbers Get

Rider against the sky. A slant artist flies off his roaring steel steed as it begins to loop.



A rider's bid for fame lasts just a few seconds—and only experts and the best machines cross the finish line in this toughest of sports on wheels.

Like a ladder—and almost as steep. This is a 280-foot course in Oregon. The champ went up it in 7.99 seconds. Strings at the start and finish provide electrically controlled timing.

to the Top

LIKE bronco busters, motorcycle hill climbers ride to a fall as often as not. Clubs vie with each other in picking the toughest course. At one national meet, riders conquered the 280-foot, 37-percent slope only 29 times out of 128 attempts.

Split-second reflexes, keen judgment, and muscles of steel are part of the equipment these slant artists need. They also have special machines. The happy lad who breezes down the highway on a beautiful chromed job would have to make several changes before joining the fraternity.

To lessen weight, he would install smaller tanks and mudguards. To improve handling, he would put on competition-type handle bars and shock absorbers or snubbers. And for better traction, he would put a skid chain on the rear tire.

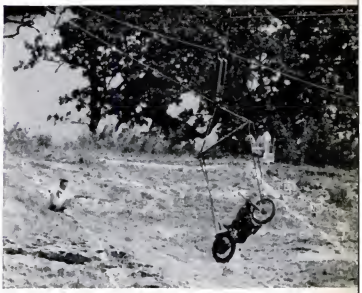
Tractor bands are forbidden by the American Motorcycle Association, the regulatory body for competition riding. But a "piler chain" can be used for a deeper bite. A piler is a longer cross chain that flaps over the regular one for extra traction.

A smaller front wheel is also an asset, for this permits the motorcycle to nose down somewhat as it climbs toward the sky. A loop-the-loop thrills spectators, but not the slant artist.

Pressing a switch button at the right second helps keep both wheels on the ground. It grounds the ignition system, momentarily killing the engine. Some clubs dig steps in the hillside. Skillful use of the button enables a rider to get over them.

For safety, every hill climber must have a cut-out, or automatic version of the button. A leather thong around his wrist clamps under a clip on the handle bar. If he is thrown, the thong goes with him and the clip springs against the handle bar. This shorts the ignition, and bystanders are not subjected to the whims of a riderless machine. END

Over the top. With both wheels off the ground, Harold Seamans breaks the finish tape at the crest of Mount Garfield in Michigan. The ride won him the title in a 45-cubic-inch class.



Reverse ski lift brings down the motorcycles at most of the major hill-climb competitions.

Hitting a button grounds the ignition, killing engine momentarily to keep machine under control. If rider falls, leather pulls out of spring clip, automatically killing the engine.

A rear-wheel chain is a must. Note the "piler chains" on this one. These fall on top of the regular links, giving more traction. Some hill climbers make pilers from a drive chain.

Three Saboteurs Lurk in Every Radiator

How dangerous are they? You can see by performing a few simple experiments.

By Kenneth M. Swezey

A CAR'S cooling system always has a tough time doing the job it was designed to do—carry off excess engine heat.

Rust may clog the passages. Hard water deposits a scale that reduces heat transfer. And if two different metals touch inside the system, electrolytic corrosion occurs.

Conditions are ideal for rust to form, and rust makes up about 90 percent of all the solids that can choke up a water jacket and radiator.

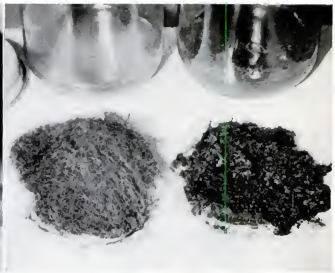
Scale is a deposit of solids left by the evaporation and boiling of hard water, such as often forms inside a teakettle. What the solids are depends upon the water. But they commonly include calcium carbonate, calcium sulphate, and magnesium oxide.

Electrolytic corrosion can result from soldered seams in copper radiators, copper gaskets in contact with iron, brazed joints in steel tubes, and imperfect plating on steel or iron parts. An electric current is set up and the metal most active electro-chemically slowly dissolves. A leak may result.

The experiments on the next page demonstrate these three forces.

Partly clogged radiator can be determined by touch. After engine has been running a few minutes, any part through which coolant isn't circulating freely will still feel cold.

Finger test: A coating of rust inside the filler neck means a thorough cleaning is overdue.



Rust Oxygen that combines with the iron in the water jacket creates rust. The oxygen can come either from water or air. Pure water rusts iron slowly. Air mixed with water produces rust 30 times as fast. If you doubt it, put a wad of steel wool in each of two screw-cap jars. Half cover each wad with water. Wet the exposed half thoroughly. Close one jar so it is airtight, but leave the lid off the other one. In a day or so, you will find the wad in the covered jar is only slightly rusted. The other wad will have almost disintegrated, as at right above. In a cooling system, a leak on the suction side of the water pump may suck in air and speed up rust formation as much as you've seen here. Air also gets in if the coolant level is low.

Scale Make some hard water by dissolving as much plaster of Paris as you can in a gallon of water. This is a form of calcium sulphate. Boil it in a small beaker, adding more water as the first boils away. Continue this and the beaker will be lined with scale. Acting as insulation, a coating of scale conducts heat only 1/32 as fast as cast iron. This causes an engine to overheat. You can show scale's insulating effect by boiling water in two small containers over one burner. To simulate scale, spread a ⅛" layer of chalk or plaster of Paris under one container, as shown in the photo at right. The water in the other beaker will be half boiled away before the water in the scale-insulated one even starts to boil.

Electrolysis This kind of corrosion results from electrical action similar to that which occurs in a simple battery. How it works can be shown by wrapping one end of a piece of copper wire around the end of an iron nail. Stand the combination in a glass of water made conductive with a few drops of sulphuric acid, left. Bubbles of hydrogen will rise from the nail as the iron begins to dissolve. Leave the setup for several days. You'll find then that the nail has almost disappeared, but the copper wire is just as good as it was in the beginning.

How can you protect a cooling system? Turn the page and see.

How You Can Curb Radiator Saboteurs

Cleaners and inhibitors, properly used, will avert most of a cooling system's troubles.

By R. P. Stevenson

SPRING servicing of a cooling system should include:

- Clearing out rust and scale with a chemical cleaner.
- Adding an inhibitor to cut down rust formation during the summer.

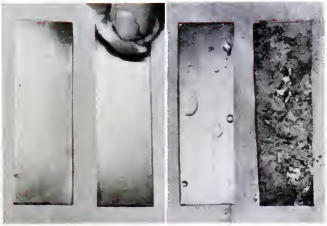
You can buy two types of cleaners—acid and alkaline. Acid cleaners do the most thorough job, but an alkaline preparation is all you need in most cases, especially if you follow a fall-and-spring cleaning schedule. Dislodging the rust may open up a leak, but a can of radiator sealer will usually close it.

There are also two kinds of inhibitors. In one, a chemical such as sodium or potassium chromate reacts with the iron surfaces and produces an oxide film that resists further corrosion. In the other, water-soluble oils spread out in a protective film. Never mix the two types.

One inhibitor treatment should last all summer—if there is no leakage or overflow loss. Antifreezes contain inhibitors, but should not be left in all summer because the life of an inhibitor is limited. The ethylene glycol in a permanent antifreeze may actually induce rust in the absence of a good inhibitor.

You can keep scale from forming by using rain water—or tap water that has been chemically treated to soften it. Water skimmed from a clear lake is also good.

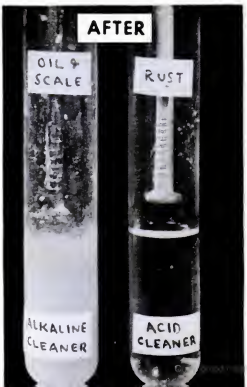
To keep electrolysis at a minimum, avoid repairs that put different metals in contact within the cooling system.

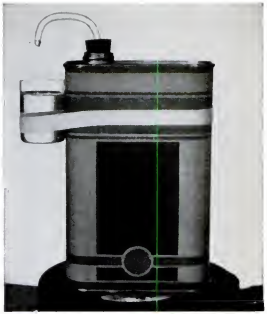


What Inhibitors Do Shine up two pieces of iron. Coat one on both sides with soluble-oil inhibitor. Cover both strips with damp paper, and keep it damp for a few hours. The unprotected iron then will be covered with rust, the other unharmed.

What Cleaners Do Rust and scale usually build up together, mixed with oil that has gotten into the system. An alkaline cleaner joins fatty acids in the oil, forming a soap. This breaks down the mixture, emulsifies it, and lets it be flushed out. Acid cleaners dissolve the rust and hard-water salts. You can watch both types at work.

Put a little concentrated oxalic (or dilute hydrochloric) acid in one test tube, and a concentrated hot solution of washing soda in another. Push a large rusty nail into the bottom of the cork of the first tube, and another nail, coated with simulated scale, into the cork of the second (left). You can simulate scale by mixing motor oil with plaster of Paris or precipitated chalk. Shake both tubes for several minutes, and here's what you'll find: the acid cleaner dissolves the rust and leaves the nail bright. The alkaline cleaner removes the scale and holds it in an emulsion suspension (right).





How to Use a Cleaner Follow the maker's instructions if you buy a cleaner. The usual method is to drain the system, fill it nearly full of water, and add the cleaner. Be careful not to let it overflow. Start the engine and drape a blanket over the hood to heat up the solution quickly and open the thermostat for full circulation. Keep the engine temperature at least at 180° F., but below boiling, by adjusting the cover as necessary while you run the engine at a fast idle 30 minutes or more. Then stop it, drain system, fill up with water, run engine at least five minutes at a fast idle, and drain again. *With acid cleaner, be sure to use a neutralizer after the cleaner.* Follow with water.

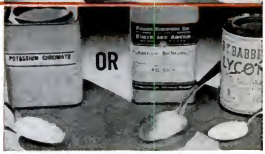
Check water level while engine is hot, never while it's cold. Here's why: Fill a can like this with cold water. Close it with a stopper through which you have placed a glass or plastic tube bent as shown. Now heat the can. As the temperature rises, water will flow steadily from the tube into the overflow glass—because water always expands when heated. If you add water when the engine is cold, some will overflow. The less often you add, the less chance for scale to build up.

How to Mix Your Own Cleaners and Inhibitor

Alkaline Cleaner You can use either sodium carbonate (common washing soda) or trisodium phosphate (Oakite and similar household cleaners are made mostly of this). For an 18-quart cooling system, dissolve three rounded tablespoons in a pint of hot water. Use it as described above. This mildly alkaline solution should do an effective job unless the system is badly clogged. If your system is larger or smaller than 18 quarts, use more or less chemical.

Acid Cleaner Buy one pound of either oxalic acid (technical grade) or sodium bisulphate from a chemical or photographic supply house. Dissolve whatever you get in a gallon of water. If you use bisulphate, add a level teaspoon of common salt to aid in rust removal. For an 18-quart cooling system, use a quart of solution, proceeding as described above. After draining acid, add the alkaline cleaner above, as a neutralizer, run engine about 10 minutes, drain, flush, and refill. *Never neglect the neutralizer.* If you do, acid cleaner will damage the system.

Inhibitor A reliable chemical inhibitor for summer use is potassium or sodium chromate, or potassium or sodium dichromate. *But don't use in cars with aluminum cylinder heads or pump impellers.* For an 18-quart system, add one rounded tablespoon of either chemical dissolved in water. If you use dichromate, add a rounded *teaspoon* of sodium hydroxide (lye). This inhibitor colors the coolant pale yellow. When samples show it has lost the color, drain and replace.



To silence squeaks in your rubbers, sprinkle talcum powder inside them. Then spread it around evenly with a small cloth.

To remove the dust that settles on leaves of house plants, use your vacuum cleaner attachment. It does the job quickly and gently.

Do It the Easy Way

To store small files neatly and still make it easy to select the one you want, stick them tang down in a strip of corrugated cardboard, rolled up and inserted in an empty coffee can.

To protect your hands from slivers of steel wool when removing varnish or paint, grasp the wad of wool in an ordinary paper clamp. The sturdy handle also gives you a better grip.

For Your "How-To" Scrap Box

All workshoppers save nuts and bolts, short pieces of fine wood, scraps of metal, and miscellaneous other objects for which they have no use at the moment. Some people call this stuff junk. But the workshopper knows there may come a time when that rusty old railroad spike will be exactly what he needs.

Storing away PS information cards pays off the same way. In them you will find handy size specifications—pipe threads, screws, nails, metal gauges, and the like—and information on many other subjects. The variety of information has no limits—and it usually is something you might have trouble finding elsewhere.

FLOORING

Usually 1″ nominal thickness, dressed to 25/32″, and 3″ or 4″ nominal width. Thicker flooring available for heavy-duty floors, both in hardwoods and softwoods; thinner, in hardwoods, for resurfacing old floors.

Vertical-grain (quarter-sawed) and flat-grain (plain-sawed) flooring manufactured in both soft- and hardwoods. Vertical-grain shrinks and swells less in width than does flat-grain, is more uniform in texture, wears more uniformly, and the joints do not open as much.

Requirements of a good flooring are high resistance to wear, attractive figure or color, minimum warp and shrinkage. Woods that combine these requirements in a high degree are hard maple, red and white oak. Others that have the requirements in a good degree are cypress, Douglas fir, western hemlock, western larch, redwood, southern yellow pine, all vertical grain. Quartered cherry, red gum, and sycamore floorings are highly decorative and suitable where wear is light and maintenance good, but they are not commonly available in lumberyards.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

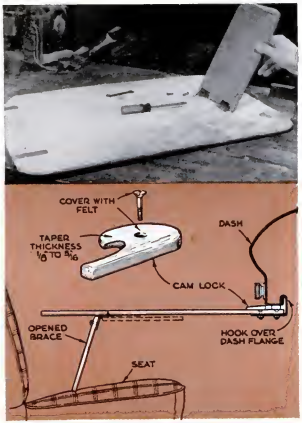
Trays Make Cars More Luxurious

Built with hand tools, these three trays will add comfort and convenience.

A TRAY is one of the handiest accessories you can add to a car. Ideal for roadside or drive-in snacks, it's also convenient for making notes, sorting papers, and reading maps. Your wife or best girl may like it too for touching up her make-up. One in the front seat and one in the back will keep the whole family happy.

Removable tray. This one gives the most tablespace. Make it of ⅜″ plywood, suiting the length and width to your car.

Bevel the top end of the brace (below) so it will open just slightly beyond 90°. Screw the brace to the tray. Bend two



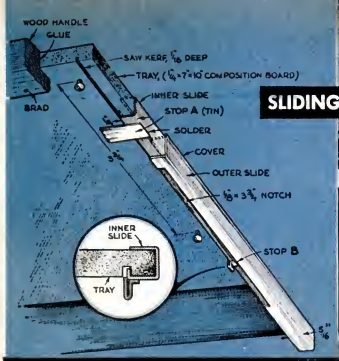
pieces of strap iron to a simple hook shape and bolt them to the dash end of the tray. In use, these hook up and over the dash flange. A cam lock, cut from hardwood, keeps the tray rigid. When it's pivoted, the tapered edge slips under the dash and gradually tightens. Cover the cam with felt.

Sliding and Drop Trays. *Construction details for these are shown in the photos and drawings on the next page.*

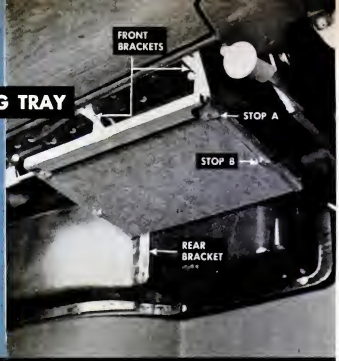
Removable tray. Carried in the luggage compartment, this one fits between the driver and passenger. One end hooks under the dash, and a hinged leg supports the other end.

Sliding tray. The space available under dash limits the size of tray installed this way, but convenience makes up for its small size.

Drop tray. This is for back-seat passengers. A wire loop hooks over the open ash tray to hold it up. Tray folds down while not in use.

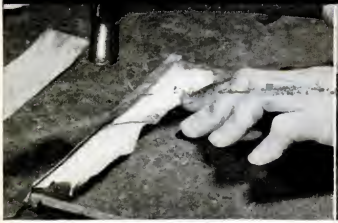


SLIDING TRAY



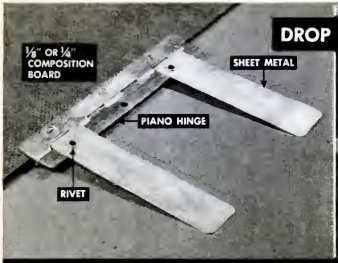
Compound slides are used. The inner slides move within stationary outer slides, travel being restricted by stops *B* and ends of notch in outer slides. Tray itself moves within inner slides, two projecting screws and stops *A* limiting travel to 3¾". Upturned lip on inner slide moves inside saw kerf that parallels tray edge. Mounting depends on screws or other supports available in car. Unit shown is suspended at front by two angle brackets. At rear a single bracket extends downward.

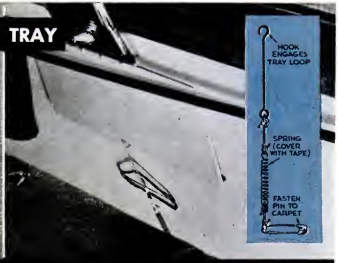
Slides can be bent from tin-can stock. Here, inner slide is being formed over tray. The sheet of paper provides clearance.



Sheet metal soldered to outer slides ties unit together, serves as dust cover. Brackets are stiffened by soldering on diagonal pieces.

DROP TRAY





Tray is attached by metal strips riveted to a 6" piano hinge, slipped under the ash-tray unit, and hooked over the top of this fitting. Hinge could also be attached directly to seat with screws. Wire loop that supports tray while in use is engaged by hook to keep it down. Spring hinges might also be used to hold tray down, eliminating spring hold-down (inset).

Plugs Connect Motor Switches

I LIKE to keep my shop motors free to be moved around for cleaning, servicing, or use on other machines. Some of my tools, however, are equipped with independently mounted reversing switches. To avoid disturbing the switches when moving a motor, I make connections through multiple-prong plugs and sockets. Suitable polarized connectors with the four or six contacts needed for this purpose are sold by radio-supply houses. The pair shown in the photo below was adapted from a truck-trailer lighting connector from which I machined off a mounting flange from the plug half. I fitted the socket into a hole in the switch housing. *—Walter E. Burton, Akron, Ohio.*

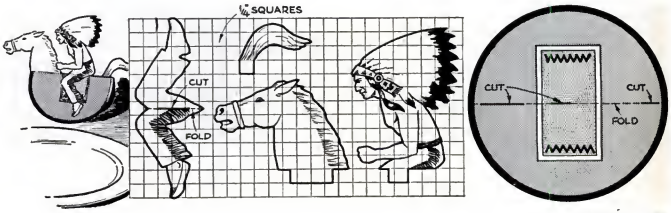
Homemade Cart Carries the Laundry

MY WIFE calls the homemade cart pictured above her backsaver. Laundry rides on a platform about 14″ by 16″ in size. A 2″ by 2″ stop in front keeps it from sliding off. A box with a lid holds clothespins.

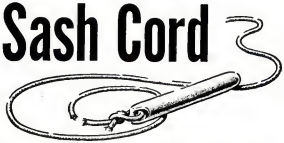
The cart's over-all height is 34″, the width 20″, and front and rear axles are 26″ apart. Two wheels came from a scooter, two from an old tricycle. The frame was made from 1″ by 2½″ scrap lumber.*—Richard C. Schneeloch, Tulsa, Okla.*

These Easy-to-Make Place Cards Add to Children's Birthday-Party Gaiety

PLACE cards for children's birthday parties can be made in a jiffy. Draw the five parts on white construction paper and color them before cutting out. Bend the circular base in half at the dotted line and cut the slots marked so that the horse's head and tail can be inserted and glued in place. Fold the leg section of the Indian in half at the dotted line and cut the slot marked. Insert the torso of the Indian and glue in place. The rider is simply perched on his mount. For variety, you can make a few cowboys or soldiers in the same way.*—H. Schmidbauer, Augsburg, Germany.*



How to Replace a Sash Cord

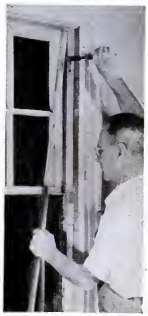


Why put up with the nuisance of one that's broken? It's not too hard to install a new one—and at same time you can lubricate the sash to prevent binding.

By Bertram Brownold

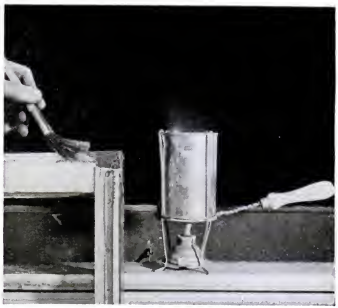
1 Pry off stop bead that retains lower sash. It may split, but you can replace it inexpensively. If one cord is still good, mark it so you can replace in same position. Loop end to keep it from dropping inside weight box.

2 Lift out the lower sash after bead and remaining cord have been removed. If there's a metal weather strip, take this out too. Small nails hold it down.



3 Pry out the parting strip next. This is a narrow molding that serves as a spacer between the upper and lower sashes.

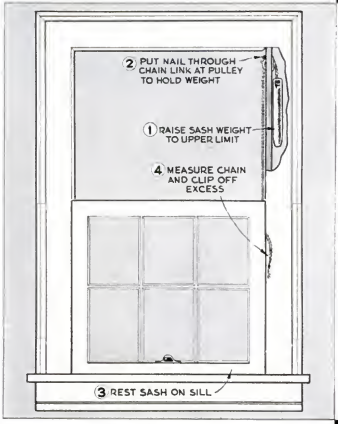
4 Upper sash then comes free. As first step in curing binding, or preventing it, sand the vertical edges of both sashes and the frame channels in which they run. Give extra attention to rubbed spots, a sign of binding.



5 Lubricate friction surfaces as next step. You can buy special lubricants, but melted paraffin brushed on works well. Melt it in a can heated by an alcohol burner. Burner shown is an oil can with a rag wick in cutoff spout.

6 **Lift counterweight** from its box as the first step in replacement of cord. To reach weight, you must pry out box lid, shown at left. Screws sometimes hold in the lid.

7 **Chain is better** than cord in any replacement job, because it lasts longer. Wire it to weight as at right after running it over the pulley and down into counterweight box.



8 **Chain can be cut** to correct length by pulling weight to top of its travel, fastening, and measuring with sash resting on sill.

9 **Fasten chain** in recess on sash edge, using a screw. At right, the chains have been fastened on both sides. Upper sash is finished.

10 **Repeat process** for the bottom sash after tacking back the parting strips. Be sure to fasten the chain with a screw, for driving in a nail might crack the glass.

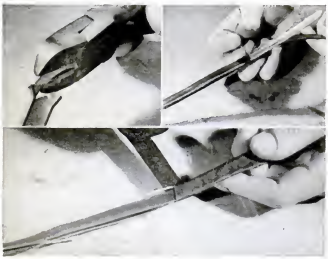
11 **Replace stop bead,** locating it so the sash can move freely. Touch up the paint—and you'll have a window that'll move up and down at a touch, without squeaks or jamming.

How to Splice TV Lead-In Lines

THAT flat ribbon that connects a television set to its antenna is an important factor in the reception of TV shows. When it is spliced, the spacing between the two conducting wires should be kept the same.

Removing the insulation: Most flat-ribbon leads are insulated with polyethylene plastic. It can be stripped off by melting it over a lighted match. Another easy way is to place it on the barrel of a hot soldering iron until an inch or two of the insulation is soft. The hot goo then can be wiped off with a cloth, and the bared leads scraped clean.

Short splices can be made this way. Bare the ends of the two pieces, hold them evenly back to back and twist the leads together. Soldering both joints will make them stronger. Straighten the joined pieces, dress the twisted leads flat, and tape them down.



Long splices are better. Notch the insulating ridge of each ribbon as shown, then pull one wire out about three inches and the other wire out about six inches. Then lap the ends of the two pieces so that the long wire on one meets the short wire on the other. Twist these pairs together, solder the joints, dress them neatly and tape the lap. Mechanically this splice is strong and durable; electrically, it's as good as new.

Penholder Used as Radio Tool

A PLASTIC OR wooden penholder is a handy addition to a radio tool kit. The insulated shaft is good for probing around the innards of a chassis. Or you can hold it by the tapered handle and use the cork or rubber finger grip as a tube tapper.—*Arthur Trauffer, McClelland, Iowa.*

Jot Service Notes on Diagram

WHEN you service a radio or TV set—particularly if you make a circuit change—mark what you have done on the diagram or set. It will help you or any other serviceman who has to trace the same circuit at a later time. If it is not your own equipment, tape a memo on or near the new part.

Wrapped Tape Makes Doughnut Tires

HERE'S an easy way to make small doughnut tires for models and toys. Wrap electrician's rubber tape (not friction tape) in overlapping spirals around a cardboard cylinder, or wood dowel, and then roll the tape back over itself and off the cylinder. Don't stretch the tape too tightly.

I use a cylinder about two and a half times the diameter of the wheel for which the tire is intended, and make a spiral wrapping about ten times longer than the width of tire wall desired. But a little experimenting may be necessary. If the tape is tacky, dust the tire with talcum or paint with sidewall paint. —*A. M. Campbell, Seneca, Mo.*

Protect yourself by wearing gloves and covering your eyes when you handle a picture tube. Hertzberg wears same goggles he uses when he sharpens tools on a power grinder.

Why Call a Television Serviceman?

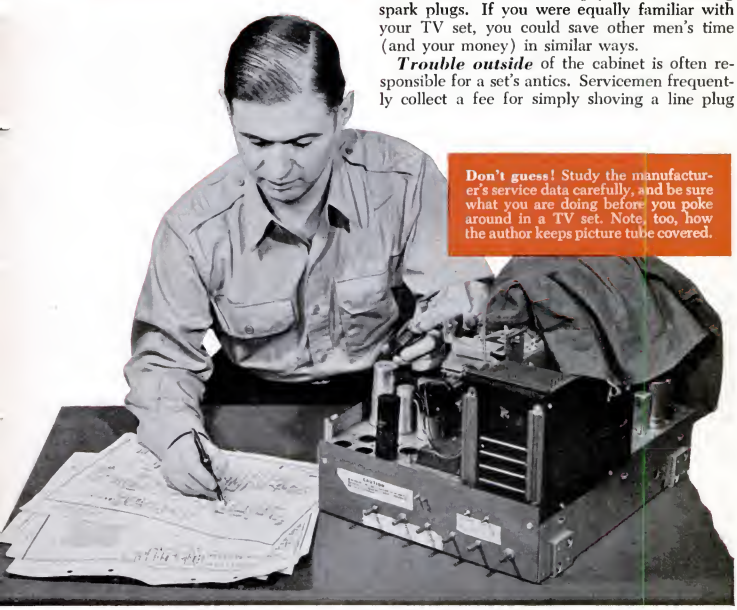
Your chances of fixing the thing yourself may be much better than you think—but don't wreck it!

By Robert Hertzberg

"WHAT? Fix something with all those tubes in it? Not me!" That's what a lot of TV-set owners think. So television servicemen make thousands of trips that aren't really necessary.

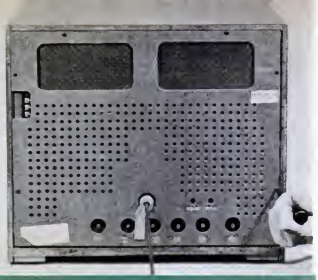
A television set is complicated. But so's your auto. And that doesn't stop you from cleaning spark plugs. If you were equally familiar with your TV set, you could save other men's time (and your money) in similar ways.

Trouble outside of the cabinet is often responsible for a set's antics. Servicemen frequently collect a fee for simply shoving a line plug



Don't guess! Study the manufacturer's service data carefully, and be sure what you are doing before you poke around in a TV set. Note, too, how the author keeps picture tube covered.

1. First step in taking a chassis out of set of this type is to pull off front knobs.



2. Safety cover on back is then unscrewed. Power plug (center) comes out with back.

Removing the chassis from a set like this is easy...

3. Bottom bolts that hold the chassis in the cabinet then are removed to release it.

4. Thus freed from woodwork, chassis can be slid out without disturbing anything on it.

back into a wall receptacle. Moving a set around to change the viewing angle may loosen its plug without anyone's suspecting it. This also may loosen the lead-in from the antenna.

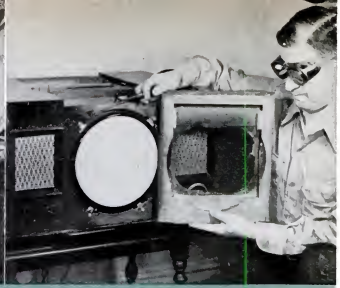
Anyone who can fix a doorbell can find and fix breakdowns outside of a set. First, be sure that the power line is okay. Then see if the lead-in still is firmly attached both to the set and the antenna arms. Note, too, whether the antenna is still the way it was before you had trouble (PS, Jan. '51, p. 169). Then see if the lead-in has been bruised. Though tough, its thin wires can be fractured—and you may only need a new piece of lead-in.

Trouble inside the set calls for some knowledge of what's there. The best *time* to find out is before the trouble occurs, and the best *way* is to study the manufacturer's service data for your particular set. If you can't get a copy from the manufacturer, try any of several book publishers who put out radio-TV service manuals. No one should tinker with his set without these service notes.

Tube failures occur more often than any other kind of breakdown. Tubes can be changed without disturbing the wiring or adjustments. Simply switching tubes of the same type will sometimes make a set work better. And a fresh tube sometimes will compensate for minor trouble in some other part of a circuit. The service notes can be used to locate both the tubes and circuits responsible for various kinds of trouble.

Many servicemen do not even take a tube tester with them when called to fix a

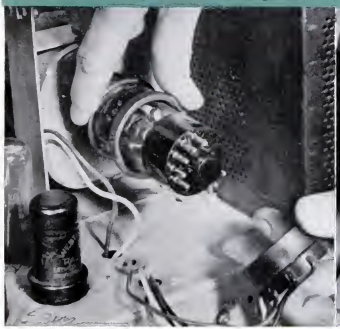
1. This cabinet supports front of picture tube and must first be opened from the top.



2. Safety mask, fastened from inside, then can be removed to make tube accessible.

. . . But disassembling a set like this is tricky.

3. Tube socket and ion-trap magnet must come off—and be put back in same position.



4. High-voltage lead from "doghouse" must be pulled off flared side of big tube.

set that has suddenly balked. They simply take a few hand tools and a carton of tubes, check the external details, then yank the chassis out, and look at the tubes.

Removing the chassis from most of the newer sets is quite simple. The picture tube is supported by a ring or frame attached to the chassis, the loudspeaker is simply plugged in, and the power line is run through the perforated safety cover on the back of the set in such a way that removing the cover disconnects the power. Loosening a few bolts enables you to slide the chassis out.

Sometimes, however, the picture tube is mounted in a basketlike frame that is structurally independent of the chassis. The chassis of such a set can be freed without removing the tube.

And in some older receivers the neck of the tube is supported by the chassis and the picture end by the cabinet. So the cabinet must be opened carefully and the tube removed before the chassis can be taken out. This is a pretty tricky job for a novice.

It's dangerous to rush into any set without first taking precautions. Get the children out of the room, because the big picture tube is susceptible to *im*plosion from atmospheric pressure if its surface is nicked or hit sharply. Modern tubes are made of well-tempered glass and there have been few accidents with them. But they are not playthings.

If the picture-tube supports are part of the chassis, keep the tube covered with a bath towel. If the tube is supported by a

Heater testing can be done with any earphones and dry cell. If you hear a loud click when you touch correct base pins (consult a tube chart or the circuit diagram), the filament inside is okay. Otherwise, tube is burned out.

separate basket, leave it in the cabinet. If it's the kind that must be removed, place it face down on a soft cloth in a safe spot.

You will probably be tempted to twiddle some of the dozens of little adjusting screws that stud the chassis. But don't touch them unless you are sure you know what you are doing. Concentrate instead on the tubes, their markings, positions, and functions.

To simplify troubleshooting, the large diagrams in service notes usually are sectionalized. By studying the set and the diagrams, the trouble usually can be localized. It is also helpful to have your tube sockets identified on your chassis. You can mark them with a grease crayon or adhesive-tape labels. Use the same symbols shown in the wiring diagram, and add the tube type number and function. For instance: V-5, TYPE 6AU6, 1st VIDEO AMP.

Nearly all of the tubes now used in TV receivers slide straight in and out of flat wafer sockets. Do not twist or turn them. Some are held by springs that grip the base and these springs must be pressed down to free the tubes. The larger tubes, of the "loktal" and "octal" types, have keyed bases; the miniatures have no bases at all, but the pin spacing orients them in their sockets.

It helps to know whether tubes are wired in parallel or series. A tube in a parallel circuit can burn out without affecting the others, but if one goes dead in a series circuit the whole string stops working. Both kinds of circuits are frequently found in TV sets.

Study the schematic diagram in your service notes that shows the actual connections of components and look especially for the wiring of the heaters, or filaments, of the tubes.

To light up the tubes while the chassis is out, servicemen connect it to a wall receptacle with a separate cord called a "cheater." If you use one, don't touch anything while the power is on.

Note how the glass tubes glow when the

TV TROUBLESHOOTING

If sound is okay but picture:	*Look first for a defect in the:*
Disappears and a bright horizontal line appears,	Vertical sweep circuit.
Disappears and a bright vertical line appears,	Horizontal sweep circuit.
Bobs up and down,	Vertical synchronizing or sweep circuits.
Darts from side to side,	Horizontal synchronizing or sweep circuits.
Folds over horizontally,	Damper tube.
Background is unstable,	DC restorer tube.
Grows larger and loses focus,	High-voltage rectifier tube.

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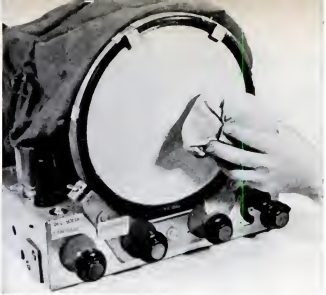
set is working normally, and you will often be able to spot defective tubes simply by looking at them. Metal tubes must be felt. Turn off the switch and disconnect the cheater after the set has warmed up, and then see if these tubes are warm. This is not always a reliable test, as some tubes run on the cool side, but it's better than no test.

The high voltages that scare many people are seldom lethal (because the amperage is low), but must be treated with respect. The high-voltage compartment is known as the "doghouse." It delivers between 5,000 and 15,000 volts to the picture tube through a fastener on the flared part of the tube. *Never put your hand into the doghouse with the power on!*

A tube with a burned-out filament should be discarded. This heater circuit can be tested quickly by touching the heater pins on the removed tube with prods that are in series with earphones and a dry cell. You'll get a loud click if the filament is good. If your service notes do not identify the base-pin connections, get a tube chart.

Even though the heater is perfectly good, a tube may not work properly or work at all in a particular spot. Try another tube of the same type and see what happens. If you don't want to buy a new tube until you're sure, perhaps you can borrow one.

The shortest-lived tubes are usually the rectifiers in the power supply. They carry a lot of current, are subject to high voltages, and run pretty hot. Deterioration shows up most quickly in the tubes used in the synchronization and sweep circuits. The most critical circuit position is that of the oscillator in the tuner section. A tube that doesn't produce any results at all there may work fine in an amplifier stage.



Cleaning the face of a picture tube often brightens pictures. Warmth and voltage attract dust and soot to the tube. Hertzberg cleans his every 60 days. Both sides of safety glass often need cleaning, too.

The picture tube usually outlasts the small ones, but its fluorescent coating may burn out before its heater does.

If your set still won't work, or works poorly, after you've checked the power line, the antenna, the lead-in and the small tubes, you need not feel apologetic about calling in a serviceman. END

To learn how to install lightning arresters, see PS next month.

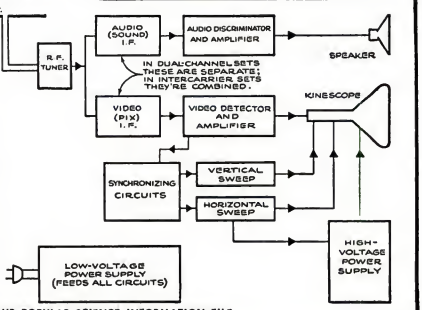
TV TROUBLESHOOTING

When sound is gone and screen is dark, look for trouble in low-voltage power.

When sound is gone and picture is okay, examine the audio circuits.

When sound and picture are gone, but the screen is bright, check the antenna, RF tuner, and intercarrier IF.

When sound is okay, but picture acts up, trouble may be in high-voltage power, synchronizing circuits, low-voltage power, or dual-channel video IF.



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How to Miter Moldings

Joining moldings—especially matching round to straight ones—may look tough. But you can do it with hand tools.

By Edwin M. Love

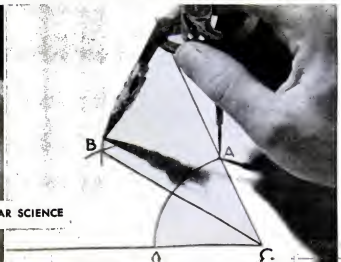
CUTTING joints in moldings is tricky business—unless you know how.

A plain flat band edging a cabinet door may look all right even if the ends of the pieces joined are not cut at exactly the same angle. But when shaped molding is used, the ends must be cut right to make the abutting beads, fillets, and coves match. And a circular molding joining a straight one of the same shape cannot simply be cut at a 45° angle even for a right-angle joint; the line of cut, instead of being straight, has to be curved.

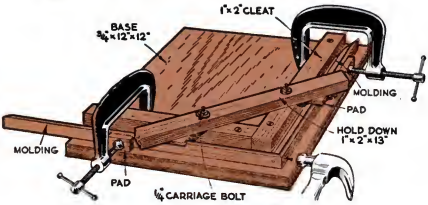
On this and the next two pages are photos showing you some of the experts' methods of doing such cabinetwork.

Miter box and back saw are the basic tools you need for mitering moldings. Box pictured at left is a simple wooden one such as you can buy at a hardware store for less than $1. It has saw slots cut at 45° and 90°. You can add slots at other angles as you need them. In use, the work should be held firmly against the back of the box, as shown in the photo.

No matter what angle is made by a joint between two straight moldings of the same profile, both pieces are mitered to one half the assembled angle. To find one half of the angle, use a pencil compass. As shown below, take the radius AC at random and draw the arc AA with C as the center. Then draw arcs equal to AA, using each A as a center, as shown below. These arcs intersect, forming the cross at B. Draw a line from B to C and you have half the angle. Set a bevel square to the angle ACB, transfer it to your miter box, and make the cuts.



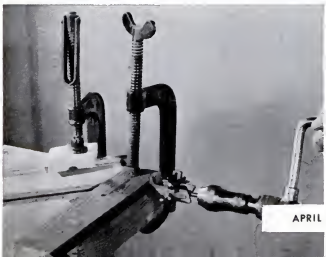
Shooting board gives first aid to inaccurately cut miters. Screwed to base is ¾" plywood set back to form 2½" rabbet. Cleats are screwed down at desired angle—45° in the photo below. Sharpen plane iron to a straight edge, and set it toward what will be upper side of plane slot. Take light cuts with bottom of plane bearing against edge of plywood. Small corrections in angle can be made by shimming one end or the other with paper or cardboard wedged between the cleat and the molding.



Picture-frame vise (left) can be built to hold moldings for nailing. Lay out cleats at right angles to each other and screw them to the base. Secure the hold-down with carriage bolts through base and cleats. Countersink bolt heads in bottom of the base. Pads or shims between the hold-down and molding are needed if the molding is narrower than the cleats. To use the vise, place the moldings with the inner edges against cleats. Close joint, tighten hold-down and clamps, and drive brads.

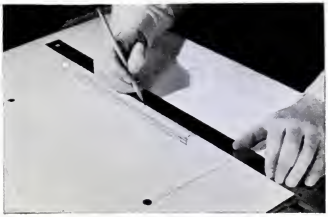
Dowels should be used to strengthen corners of large frames. An accurate way to bore the holes is shown below. Clamp the molding to a bench and clamp a previously bored guide block against the mitered joint at correct angle and location. A bit gauge on the bit controls hole depth. Cut dowels ⅜" shorter than holes they will fill, and chamfer their ends. Assemble with glue and clamps.

Molding can be mitered on a circular saw. Clamp or screw an auxiliary head to the miter gauge. Glue a piece of sandpaper, grit side out, to the auxiliary head to keep molding from creeping. Run a few test cuts on scrap to test accuracy of setup. Then cut one end of all pieces. Swing miter gauge for other ends, run tests on scrap, mark molding lengths exactly, and then cut miters. *[Turn the page.]*



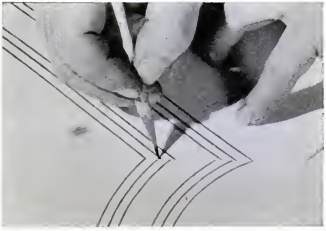
How to Make a "Hunting Miter"

1 Joining straight and curved molding calls for a hunting miter. Trace the profile of the straight piece first (left). The process is the same regardless of the angle at which the pieces meet. The line where they meet must be a curve. Otherwise, the beads and coves of the two pieces will not match.

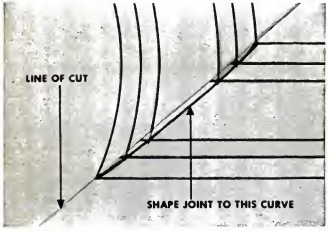


2 Draw parallel lines, as shown above, to indicate each bead and cove of the straight molding. Use a drawing board and a T square for this operation if you have them. Then it will be easier to get the lines parallel.

3 Lay out arcs with a compass (above) to represent spacing of beads and coves of curved molding. Both of the drawings of the curved and straight pieces must be full size and carefully made.



4 Cut the drawing of the straight molding at the angle you wish it to join the curved one. Then fit the two drawings together. As you can see, the lines representing the outside edges of the moldings meet on the straight cut. But the beads and coves do not meet along the line of the straight cut.



5 Continue the arcs that represent the beads and coves of the curved molding until they meet the lines on the drawing of the straight piece. Connect the points where the lines meet, as shown above, and you'll have a gentle curve. That's the line on which the moldings should be cut if you want them to join properly.

6 Hollow end of straight molding to conform to the curve, and crown the end of the curved piece to the same curve. Drum sander (above) does good job of hollowing end of the straight piece. Disk sander is handy for crowning end of curved molding. If you don't have those power tools, use chisels and a cabinet file. As you work, fit ends of moldings against your drawings to check accuracy of your cuts.

Pleated door folds back into a bundle six or seven inches wide. Anyone can install it from a kit. Doors come in various sizes and colors.

A Folding Door Saves Floor Space

Modern, pleated door can be put up with a screwdriver in less than an hour.

GETTING in and out of a room would often be easier if the door weren't there. The bathroom door in our house swung into the hall and created a traffic bottleneck. So we took it down and put in a new accordion-type fold-up door.

Modern pleated doors of vinyl-plastic fabric on steel frames are used most often as between-room partitions, but they also come in regulation door sizes. Installation is simple—actually easier than hanging an ordinary door. And when a folding door is bought to fit a standard opening, it's a screwdriver job all the way. The kit we used, including hardware, costs about $26.—*Darrell Huff, Sonoma, Calif.*

Next Month: ***Two Ways to Make Dutch Doors***

1 After the old door is removed, the roller track is hung from the top of the frame. Clips under the track will hold the cornice.

2 Fasteners for the fixed edge of the door are screwed to the jamb. The door is then pushed back and attached to these clips.

3 Strike plate for the latch can be mortised in or surface-mounted on opposite jamb. Doors come with either plain or lock-type latches.

4 Cornice is just pushed into place; it's held by clips inserted between frame and roller track. All parts are supplied with the door.

Plastic-Faced Decorative Wall Tile Serves as Insulation, too

THESE 12" wall tiles are formed of ½"-thick insulating board faced with Velon-plastic sheeting. Called Wonderwall, the tiles are sold by the Page Panel Co., Cresskill, N. J., in both regular and waterproof types for installing over concrete, cinder block, brick, wood, or plaster.

To install, blobs of cement are applied to the corners of the tongue-and-grooved blocks, and the blocks are pressed against the wall and slid into place. They can be cut to fit around openings or to fill small spaces. The plastic is lifted from a slot in the side of the block and cut 1" longer than needed. The board is then cut to required size and the plastic folded over it and stapled fast. The finished wall is said to withstand long, hard wear without cracking, chipping, or discoloring. Stains and dirt can be washed off with soap and water.

Curtain Spring Used as Belt

I HAVE been using a spring-type curtain rod as the driving belt on my 12" lathe for nearly two years. The spring was shortened enough so there would be some tension. The ends were hooked together, and the entire spring wrapped with two layers of tape.—*Ranjit Singh Pamani, Calcutta, India.*

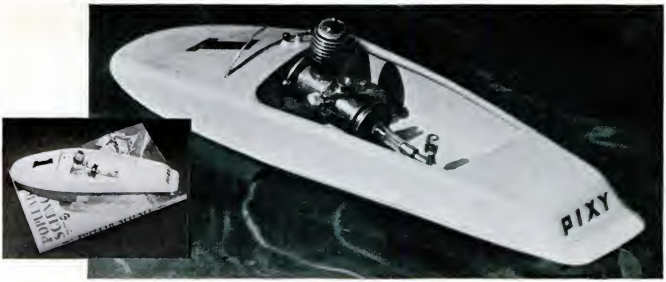
Broken Fork Forms Wall Holder

WHEN an inner tine of a plastic fork breaks off, don't discard the fork. Break off the remaining inner tines and bend down the handle as shown, after holding it over a flame or under very hot water. Screwed to the wall, it makes a neat holder for a rubber stamp, or any kitchen or shop tool with a similar handle.—*John J. Rea, Urbana, Ill.*

Door Catch Holds Wind-Blown Paper

SPRING-TYPE screen-door catches attached to outdoor market counters grip wrapping paper and bags even in strong wind. Single sheets or bags are easily pulled out as needed.—*O. C. Grant, Springfield, Mass.*

They work for a hardware store. The real name of a loafer cushion is a spike rail. You've probably seen them along the sills before some show windows. The spikes are intended to discourage anyone from sitting on the sill.

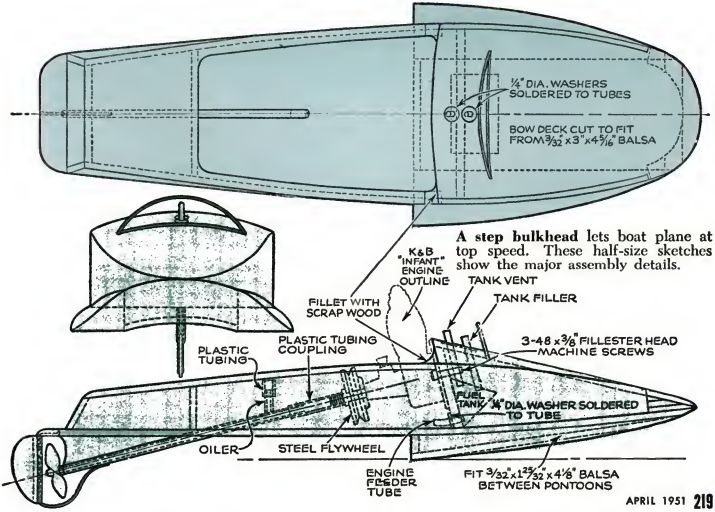


Thumbnail Speed Boat Skims the High Spots

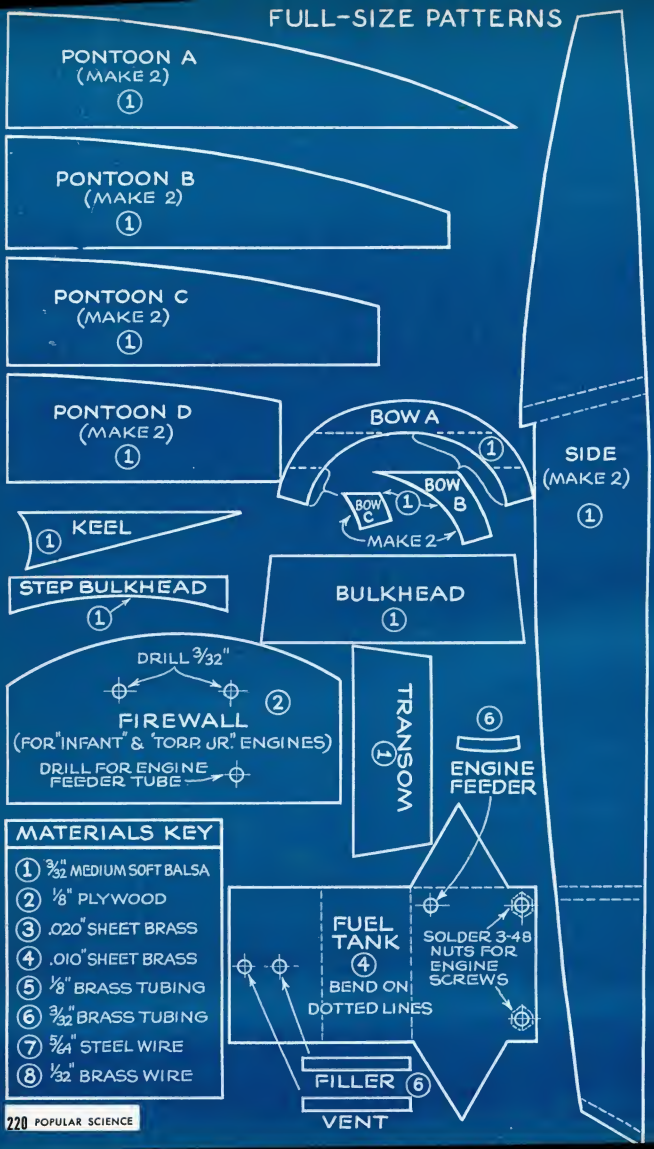
Less than a foot long and weighing only a few ounces, this tiny engine-driven racer can be built in about 10 hours.

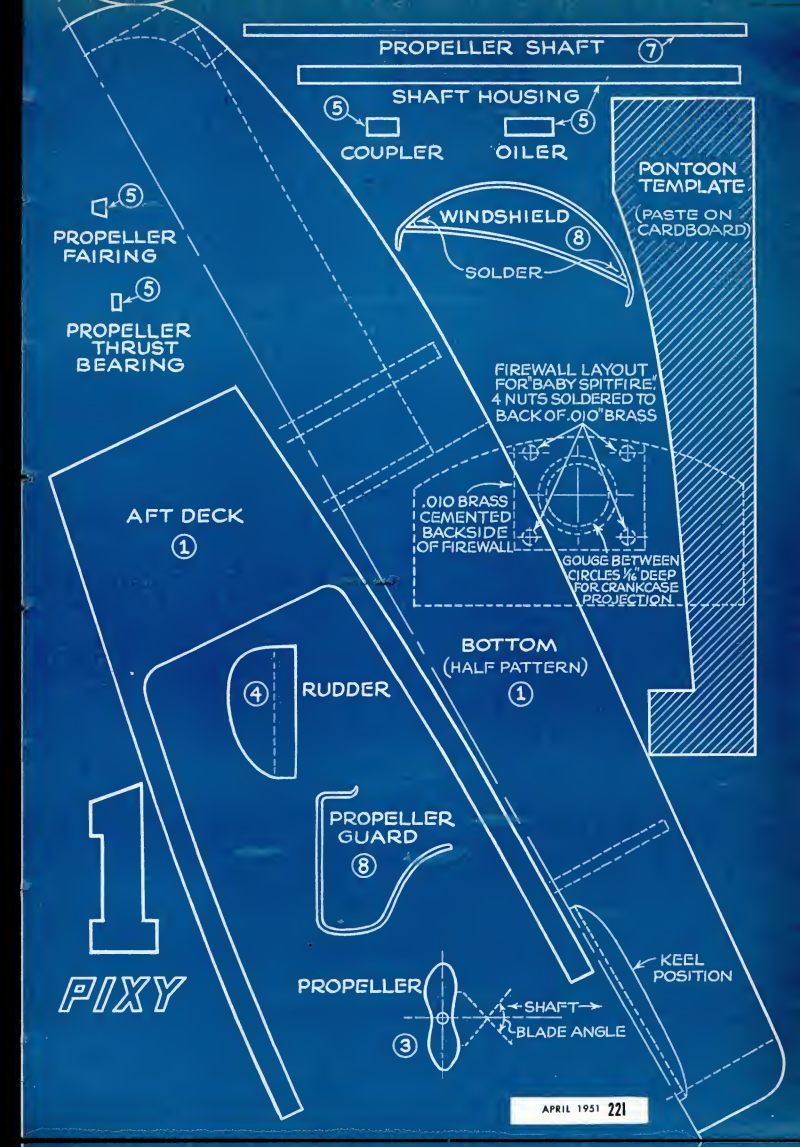
By Jack Wilson

HERE'S some summer fun for modelmakers—a 10″ hydroplane that skips around a pond or pool at a fast clip. Powered by an inexpensive glow-plug model-plane engine, it covers a quarter mile on a



A step bulkhead lets boat plane at top speed. These half-size sketches show the major assembly details.


FULL-SIZE PATTERNS
PONTOON A
(MAKE 2)
1
PONTOON B
(MAKE 2)
1
PONTOON C
(MAKE 2)
1
PONTOON D
(MAKE 2)
1
BOW A
1
BOW C
1
BOW B
MAKE 2
SIDE
(MAKE 2)
1
KEEL
1
STEP BULKHEAD
1
BULKHEAD
1
DRILL 3/32"
2
FIREWALL
(FOR "INFANT" & "TORP. JR." ENGINES)
DRILL FOR ENGINE FEEDER TUBE
TRANSOM
1
6
ENGINE FEEDER
MATERIALS KEY
1 3/32" MEDIUM SOFT BALSA
2 1/8" PLYWOOD
3 .020" SHEET BRASS
4 .010" SHEET BRASS
5 1/8" BRASS TUBING
6 3/32" BRASS TUBING
7 5/64" STEEL WIRE
8 1/32" BRASS WIRE
FUEL TANK
4
BEND ON DOTTED LINES
SOLDER 3-48 NUTS FOR ENGINE SCREWS
FILLER
6
VENT


PROPELLER SHAFT 7
SHAFT HOUSING
5
5
COUPLER
OILER
PONTOON TEMPLATE
(PASTE ON CARDBOARD)
WINDSHIELD
8
SOLDER
5
PROPELLER FAIRING
5
PROPELLER THRUST BEARING
FIREWALL LAYOUT FOR "BABY SPITFIRE," 4 NUTS SOLDERED TO BACK OF .010" BRASS
.010 BRASS CEMENTED BACKSIDE OF FIREWALL
GOUGE BETWEEN CIRCLES 1/16 DEEP FOR CRANKCASE PROJECTION
AFT DECK
1
BOTTOM
(HALF PATTERN)
1
4
RUDDER
PROPELLER GUARD
8
1
PIXY
PROPELLER
SHAFT
BLADE ANGLE
3
KEEL POSITION

two-minute fuel supply. You can run it free or on a tether. Watertight compartments make it sinkproof.

The speedster was designed for a familiar model-shop engine—the .02″ Infant Torpedo. But the newer .035″ Torp Jr. requires no design changes, brings the total weight up to only 3¾ oz., and has lots of reserve power. The plans also show how to mount a .045″ Baby Spitfire engine.

Cutting out the parts. If you are careful, one 3″ by 36″ sheet of medium-soft balsa will do for all hull parts. Sand fuzz from the sheet, trace the patterns, and cut out with a razor blade. Cut the ⅛″ plywood firewall with a jigsaw and drill 3/32″ holes for the engine-mounting screws and fuel pipe.

Paste tissue tracings of sheet-metal parts to brass stock. Cut with tin snips and file the edges smooth.

Twist the propeller blank so the blades are at the indicated angle half way out from the hub. Flatten the blades slightly toward the tip. Round off the front face with a file, tapering to sharp edges.

Assembly. The photos show how to put the hull together. If you substitute a ready-made model-airplane fuel tank for the one shown, solder the engine-mounting nuts to a strip of brass, and cement the strip to the firewall. Engine vibration would loosen the nuts if they were cemented directly to the firewall.

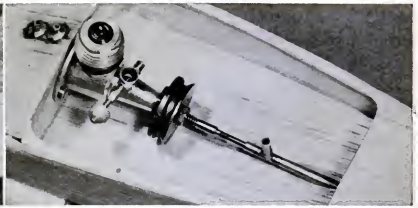
Doping and finishing. Plug the fuel-tank tubes and oiler to keep them clean, and smooth the hull with 3/0 sandpaper. Brush on clear dope and sand again.

Then cover the model with Jap rubber model airplane tissue, applying it with cement thinned out to brush easily. Brush two coats over the tissue, and, when dry, smooth with No. 400 waterproof paper.

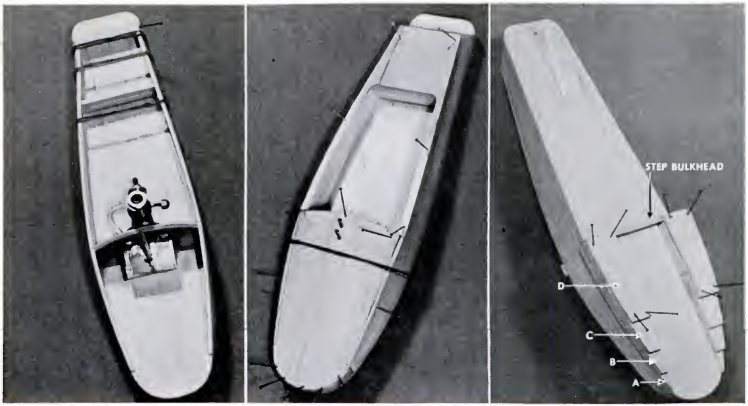
You're then ready for color doping. The boat shown was painted yellow and green with black lettering. Use only a fuel-resistant dope. Sand all but the last of the four coats with No. 600 waterproof paper. Lettering can be cut from Trim-Film, a decal material. Soak and apply in the usual manner. Then coat with thinned-out cement.

Cement bow pieces *A, B,* and *C* and front tips of sides to the bottom. Use a fuel-resistant cement, such as Aero Gloss C-7700. Steel wire makes a handy cement applicator. Cement all the parts very carefully. During assembly, steam the balsa lightly if it resists bending.

Bend edge of rudder around the prop guard and solder along seam. Solder guard to shaft tube and the prop to shaft, facing the prop on opposite sides with the bearing and fairing tubes. Coat shaft tube and keel with three layers of cement after lining up tube with engine.



Align shaft tube for cementing by sliding the shaft forward against flywheel center. Solder the oiler to shaft tube. Use plastic tubing to connect engine to a coupler soldered on end of shaft. Solder ¼″ brass washers to fuel-tank tubes and coat with cement to prevent leaks.



Bevel firewall, bulkhead, and transom edges to fit. Cement sides and hold with pins and rubber bands. Assemble fuel tank and cement to back of firewall with engine in place. Add the aft deck, taper the bow pieces with a razor blade and sandpaper, and fit on a piece of 3/32" balsa as the bow deck. Fillet front corners of the cockpit with scraps of balsa. Cement on pontoon pieces, step bulkhead, and keel. Shape the pontoons to the template. Fit balsa between them, cementing one end on the curved bulkhead. Fair this piece into pontoons.

Rub down the finished boat with rubbing compound and apply a coat of auto wax.

Starting the engine. Prime it by squirting a drop of fuel into the cylinder above the piston and another into the intake. Take one turn of a 36" length of twine around the flywheel (a standard model-shop item to convert plane engines to boat use). Press the boat between your knees with the stern towards you. Connect the starting battery and smartly pull the end of the cord.

Adjust the engine for smooth, slow-speed operation and lower the boat into the water. At rest, the tip of the bow is ¼" above the water. At top speed, it rises to about 1". Readjust the engine if necessary when the propeller is under water. Release the boat by letting it go quickly, but don't push.

Making a tether. You'll have most fun with a free running boat, but it operates nicely on a tether of .010" steel wire about 10' long. You can use a piece of broom handle as a center post. For a pivot plate cut out a 1" strip from .020" brass stock and punch ⅛" holes in each end—one for a nail driven into the post and one for the tether.

Make a bridle from a 4" piece of 1/32" steel wire. Bend an eyelet in one end for attaching to the left engine-mounting screw. Form a ½" U-shaped hook at the other end for engaging the loop at the line end. Bend the bridle down and slanting towards the back so the boat hangs level.

If the boat should hit a wave and get dunked, remove the glow plug and pump out the water by twirling the flywheel with the starting cord. Flush the engine and run it to clear out any water. END

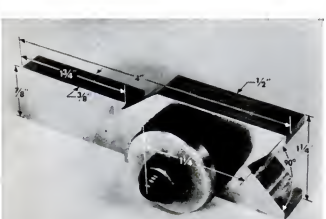
Next month: How to build a model jet interceptor plane.

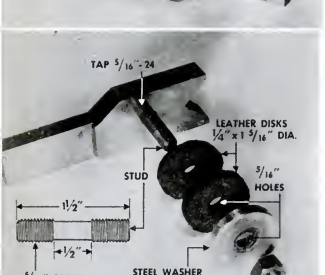
Special mounting plate is needed for the Baby Spitfire engine. Make this as shown in plans. A ⅛" balsa strip below it holds fuel tank away from mounting screws. Bend strip at top of tank to L shape and sweat-solder to mounting plate. Cement the tank at the bottom.

How to Wind Small Springs

With this tool you can handle that tough spring wire safely.

Any good back-geared, screw-cutting lathe is a natural for rolling your own springs. But spring wire is tricky stuff, full of unpleasant surprises if wound with makeshift setups. Here's a simple tool that takes the grief out of such jobs.





With it you can make comparatively heavy springs of small diameter, for the V nose will support a thin mandrel close to the winding point. Tension or compression springs up to the full length of the lathe ways can be wound, because the tailstock is not needed to support the free end of the mandrel.

The body of the tool is most easily shaped from brass. Thread the stud to a tight fit in the tapped hole so that it won't turn when the friction disks are being adjusted. Turn the steel washer from 1 5/16" bar or ⅛" flat stock, chamfering one edge. Make two ¼" thick leather friction disks with a circle cutter, or turn them between clamping collars in the lathe.

With the spring mandrel chucked and the carriage near the chuck jaws, clamp the winder in the toolpost so that both sides of the V notch touch the mandrel lightly. Then run the carriage to the end where winding will begin. For a right-lay spring, bring the wire up from underneath, clamping it between the leather disks right against the stud. (One photo shows a left-lay spring being wound, the wire going over the stud.)

Insert the wire in a hole in the mandrel, grease the latter, and run the lathe at its lowest back-geared speed. Use a carriage feed to suit the wire diameter or the turn spacing.—*Richard J. Decker, Brooklyn.*

Removing Resin from Saw Blades

To remove pitch or gum from bandsaw and circular-saw blades, soak them in kerosene. Use any flat container and a small amount of kerosene. Coil a bandsaw blade and lay it in the pan teeth up. After the blades soak for several minutes, remove them and brush them with a stiff-bristled brush. Dry and oil the blades before storing them.—*E. P. Alexander, Jr., Plymouth, Mass.*

Sanding Disks Made in a Hurry

To cut out a quantity of sanding disks for use in electric-drill sanders, staple a small pile of assorted sandpaper sheets together (or nail at the corners to scrap plywood) with the top sheet wrong side up. Trace as many disks on the sheet as will fit and saw through the stack of sandpaper with a worn, fairly coarse blade in your jigsaw.—*M. J. Stinson, Vista, Calif.*

The Inside Story of Our Expansion Attic (Part 3)

From Plasterboard to Finished Rooms

How two amateurs finished off the bedrooms they built to make their house bigger.

By Mary Ellen Goodman

PS STAFF PHOTOS

SUPPOSE, for a moment, that you were finishing an expansion attic. The hot-water heating pipes are in and capped, pending the arrival of radiators. You're going to be away a few days, but you set the oil-burner thermostat at 55° to keep the heating plant running and the house well above freezing temperature. Wouldn't you

Something has been added to the desolate southwest corner of our attic (at left). Today it's a cozily livable room. The unseen wall to the left, facing the window, affords space for the bed headboard and vanity bench. In the right-hand wall there is a roomy closet, shown on a following page.

Drawers are all 8″ high, as we were told that 8″ common pine was the widest that wouldn't warp badly. Above the partly pulled-out drawer can be seen the runner for the next one, a 1″ by 1″ oak strip backed with ¾″ plywood to form a rabbet in which the drawer slides. The overlapping drawer fronts act as stops.

feel all should be well? You probably would.

We did too—and the result was the worst setback we encountered in making our attic livable. While we were away the water in the dead-ended pipes froze, even though it was being heated in the basement. A pipe burst, and the house was flooded.

Thus we learned, the hard way, that if you run hot-water heating pipes upstairs without installing radiators, you should either put a shutoff valve in these lines, or connect the two pipes at each radiator location so that the water can circulate. With steam or hot-air heating, of course, this problem wouldn't have existed.

The big mop-up. After we cleaned up, we assessed the damage. The attic itself hadn't suffered much; only a small part of the flooring had to be taken up to replace the pipe. Things were worse in the rooms below, but eventually we were able to turn back to our attic project.

The work coming up promised to be the most exciting so far, because what we did next would show in the finished job. With plasterboard walls outlining the rooms, it was time for those individual touches that would tailor the rooms to our needs.

Drawers under the eaves. Where the ceiling sloped below normal headroom, our plans called for built-in drawers. These would replace chests and dressers, saving just that much precious floor space.

We had carefully leveled the studs between which the drawers were to slide, and straightened those that weren't plumb. This wasn't hard, but we were afraid that building the drawers might be beyond our newly acquired skills.

We were fortunate, however, in two ways. POPULAR SCIENCE lent us a circular saw, and a good friend, Ted Simon, showed us how to use it. With hand tools only, we could have built drawers having glued and nailed butt joints. But with these helps we were able to have rabbet-and-dado joints, and drawer bottoms set into grooves.

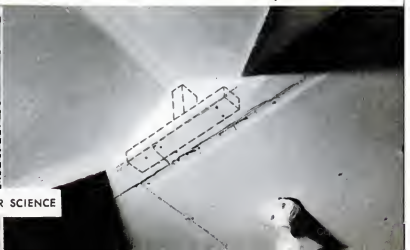
All the parts for the 24 drawers (eight for each room) were cut at once. We made the drawers 8″ high but varying in depth according to their position under the eaves.

There is a shallow drawer on top in each bank, with two 24″ drawers beneath and a 36″ deep bin at the bottom. This is for blankets and other large pieces, and the front is held by hooks that, when released, let it drop on hinges.

Runners were made of oak because pine would score in use, and were screwed, not nailed, to the studs. Ted shaped some long strips of pine on the saw into handsome modern drawer pulls, which we put on with glue and nails.

We made our doors. Happy about

Irregular beam spacing, grilles, and dormer angles compelled us to put up plasterboard piecemeal in some areas. Dormer peaks were especially tough, as the photo at left below shows. The photo of the other dormer (below) shows the T-shaped two-by-four nailing members we set in. A triangular piece of board was fastened to these. Plaster closed the joints.



our success with the drawers, we tackled door construction. Plans called for both sliding and hinged doors. Three of the latter were oddly shaped, and none was a standard size, so we found we could build our own cheaper than we could buy them made to order.

The most expensive material we bought was the framing lumber for the doors. This was clear pine, especially seasoned against warping. Ted Simon again helped us out. Originally we had planned to build frames and cover them with ¼″ plywood on both sides, making flush doors. But he showed us how to groove the framing and set plywood panels into the grooves. The resulting doors were lighter and required only half as much plywood.

It was fun shopping for sliding-door hardware. Some kinds are quite costly, but we found two that suited us. For the light doors opening on storage space, we used floor tracks mounted on an oak threshold strip. Ball-bearing units, in which the balls follow an oval course in a pressed-steel housing, were set into mortises in the bottom door edges. At the top, these doors slide in tracks made by nailing narrow strips to a broader piece.

Like the room doors, the sliding closet doors were made by setting panels into grooved frame members, but we used Masonite instead of plywood because it cost less and was adequately strong.

The big sliding doors in the south bedroom run on overhead trolleys. Two-wheeled hangers fastened to the doors at the top roll in special double tracks. Guide strips on the bottom keep the doors aligned.

Trim was our next job. This is wood framing that covers studding around doors and windows—and, incidentally, the edge of the plasterboard. Common 1″ by 4″ pine served for most of this, except in a few places where we had left too wide a gap and had to use 1″ by 6″. The baseboards around the rooms are 4″ stock, topped by standard baseboard molding. We simply butted the baseboard at the corners, but the molding had to be mitered.

On any job like this, especially with built-in drawers, there are numerous places where pieces must be individually cut to fit. If some part isn't square, you often have to cut the trim to match.

Hiding wallboard joints. When putting up the plasterboard, we damaged an edge or a corner here and there, but hoped

The closet wall in the south room was a patchwork of plasterboard scraps, left over from fitting larger areas. We felt it wouldn't matter if this hidden wall was rough, but it turned out fine. The closet is big enough to walk in, going back under the eaves. Its sliding doors don't infringe on floor space, and there's ample headroom for putting in hat shelves.

the final plastering would hide such defects. It really did, although naturally you should try to do as clean a job as you can. The closet wall in the south room shows what careful joint finishing can do. Since this was a hidden wall, we pieced it out with more than twenty scraps of plasterboard, saving our big panels for more conspicuous areas. Taped and plastered, the closet wall looks as good as the rest of the room.

Our wallboard showed many gaps wider than they should have been. We spent some time filling these with strips of wood or plasterboard, for trying to plaster an open gap is like carrying water in a sieve. You can't pack the joint with cement if there isn't a firm back to it.

The materials for finishing plasterboard joints are a special cement and a roll of perforated tape. We also procured a trowel and a wide-blade putty knife. The cement, actually a kind of plaster, is simply mixed with water to a mortarlike consistency. The photos show the steps in covering a joint. After the first coat dries for at least 24 hours, you have to apply a second coat.

This cement dries very hard, so it's better to remove any excess from molding, trim, and so forth before it sets. However, it can

be smoothed with sandpaper wherever it's rough.

In corners, cement is applied the same way, but the tape is folded lengthwise before it is applied. The finishing coat is applied to one side of the corner at a time. All nail heads have to be covered with plaster also, even those in the middle of panels, away from the edges.

While the cement dried we sanded the woodwork, set all nails, and filled over them with a crack filler, which also had to be sanded when dry.

At this time, too, we had the radiators installed. Our plumber found secondhand ones that cost us only a fifth of what new ones would have. They were scarred and rusty, but we gave them a coat of flat paint and they look fine now.

Paint was rolled on. Experts told us that patterned wallpaper would conceal irregularities and defects in the plastering better than paint, but with a child in the house we felt that washable, painted walls would be more practical.

First the trim was primed with enamel undercoat. This came white, but we tinted it just a bit lighter than the finish color was to be. Drawers were removed, as it was easier to paint them upended. We used a 2″ and a 2½″ brush for most of this, but a ¾″ brush came in handy for the drawer edges and baseboard molding.

For the walls we used one of the new paints that require no primer coat. It was applied with a sheep's-wool roller, and it covered beautifully.

Paint rolling was a new experience to us, but surprisingly easy. The roller left no brush marks or hairs, and covered vast areas in a sweep. It could be rolled in any direction, no small advantage in rooms with so many odd corners and angles as ours.

We found you mustn't overload the roller, or it will pile up paint at the edges (although an extra sweep or two levels this out). Nor must you roll too fast, or you become the recipient of a fine rain of paint, thrown off by centrifugal force. Only moderate pressure is required; if you have to push hard, you need to redip the roller in the paint tray.

With care you can roll paint in the corners, but it seemed better to us to use a brush in tight quarters. It doesn't take long, and you quickly make up lost time with the roller.

Although this one-coat paint job may be thin, it looks good and will do nicely for the present. After Steve has tried out his crayons on the walls, we'll have to give them a second coat anyway.

With the walls done, we applied semi-gloss enamel to the trim, drawers, and baseboards, choosing fairly dark colors that we hope won't show dirt readily.

We'll tile the floor. For the present, we've laid some old rugs on the subfloor, as the photos show. When time and the budget permit, we'll put down an underbase of

Nail heads, even those not along joints, must be sunk a bit below the plasterboard surface (arrow) and buttered with cement. You get to be fast after a little practice.

First step in finishing joints between plasterboard is to fill the gap with special tape cement like this. Gaps more than ¼″ wide should be closed with filler strips.

Right over wet cement, apply special perforated tape. Smooth it down hard with the knife so that cement oozes through the holes. To cut tape, tear it along the knife.

Apply more cement over tape with a trowel and spread it well into area alongside joint, thinning it out at edges. When dry, put on second coat, let dry, and sand smooth.

Bigger than it looks here, the north room gives Steve lots of play space. There's an access door to storage space in the unseen wall at left above. Electric outlets are the safety type. Sliding doors alongside the drawers (right) open on as thrilling a hideaway as a kid could want. This space is big enough to convert to a child's closet as he grows.

plywood or one of the hard composition boards—which you need for an even support —and then tile over it.

We'll probably use asphalt tile because it's long-wearing, comes with its own felt base—which you also need—and is one of the least expensive types. It even comes now in a grained pattern that looks like wood and can be laid to simulate a parquet floor. Linoleum, rubber, and cork tiles are all less brittle, softer underfoot, and maybe handsomer, but they're also more costly.

In any case, the tiles should be easier for the amateur to put down than roll linoleum, although this is perhaps the cheapest floor covering. And we've decided on the 2′ tiles instead of the smaller 9″ size, which should also save work.

Our house is bigger. It's hard to believe what a difference those extra rooms make. Steve has plenty of space to play in, and his toys aren't all over the living-room floor any more. We can entertain friends downstairs while he sleeps contentedly upstairs. Overnight guests are no longer a problem. They can have a private room, with closets and drawers.

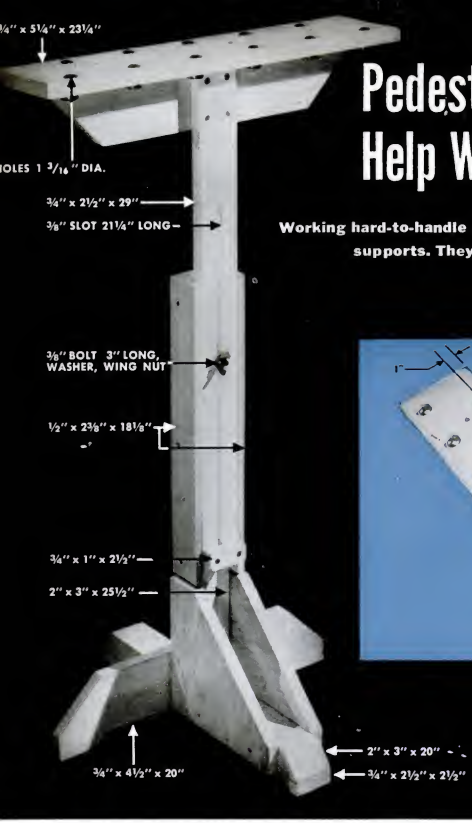
Furthermore, having done so much ourselves, we are twice as proud of our upstairs as we would be if we had let a contractor do the work (which would have cost us more than twice as much). END

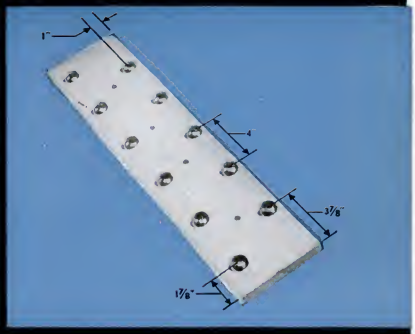
Collar Protects Jigsaw Bearing

I HAVE found that a rubber or leather collar under the lower chuck of my jigsaw deflects sawdust and metal chips from entering the bushing around the reciprocating member. Metal chips especially cause wear. An inner-tube patch or a circle cut from an inner tube will do.—*H. Jones, Brooklyn.*

Pedestal Bearings Help Woodworkers

Working hard-to-handle pieces is a cinch with these supports. They roll stock in any direction.

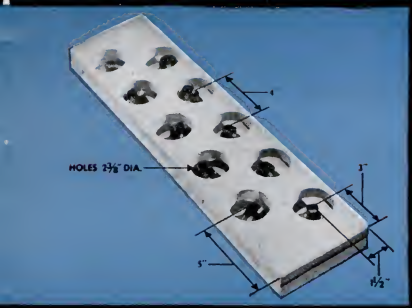




By Herbert Pfister
PS PHOTOS BY HUBERT LUCKETT

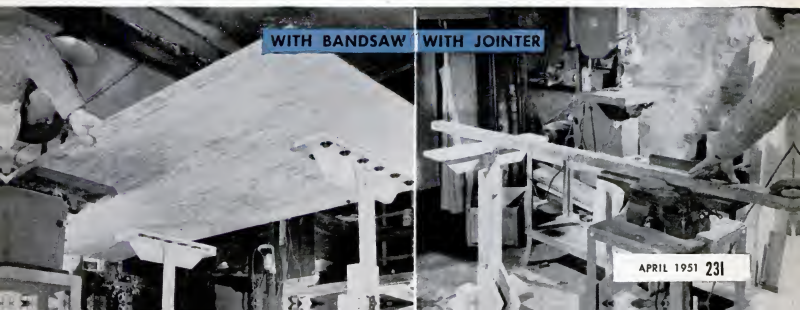
EVER try to bandsaw patterns from a 4′ by 8′ plywood panel? If you have, you know what a headache it can be without proper supports for the work. Pedestals are often actually better than a helper in handling awkward pieces because there's no problem in coordination to prevent binding.

These outboard supports—unlike the straight roller type—will let you slide the work over them in any direction. They are adjustable for height in case your machine tables vary. Construction is easy. The parts are just screwed together.



Swivel casters carry the work over this head (above). Casters are flat-plate type, screwed to ½" piece. Casters protrude through clearance holes in ¾" piece.

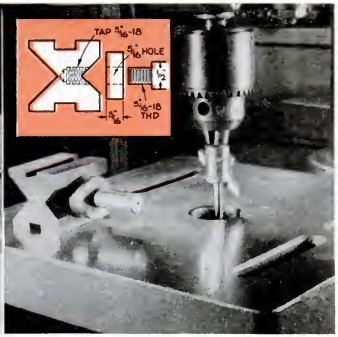
Ball casters do the job at the left. Only one piece of ¾" stock is used for this head. Casters are fastened with screws from underneath the head of the pedestal.



WITH CIRCULAR SAW

WITH BANDSAW

WITH JOINTER



Self-Centering V Block. Once set up on a lathe or drill press, this V block remains accurately centered for drilling on a diameter any size of round stock within its capacity.

Clamp an unhardened (cast-iron) V block on the drill-press table, accurately centering it under the spindle. In the bottom of the V, start a hole with a center drill. Shift to an F drill (.257″) and tap 5/16″-18.

Mount a fly cutter as shown at right above and, at the slowest spindle speed, carefully counterbore the hole in the table. Set the cutter out a little for each successive cut until the bore is smooth.

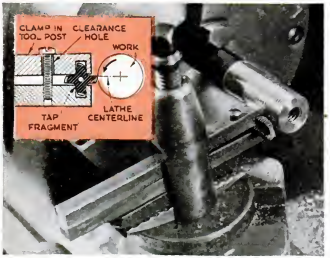
Shoulder down and thread a stud in the lathe, as shown in the drawing, leaving a straight shank to be gripped in the tailstock chuck. Or, if you prefer, turn this end to a Morse taper to fit the tailstock ram.

Machine a collar to a close push fit in the counterbored table hole. Both faces of the collar should be square, and the bore and outside diameter concentric. Therefore machine both at one chucking, or mount the collar on a mandrel to turn the outside.

In using the block, the drill-press table must of course be swung about to bring the V groove in alignment under the spindle. *—Floyd McGuckin, Ridgewood, N. J.*

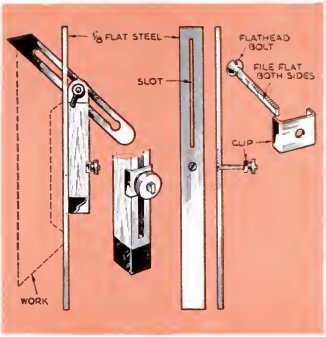
Tap Cuts Threads in Lathe. Broken taps can be used for threading in the lathe—often with better results than with a single-point tool. They're faster because fewer passes are required; one is enough for some jobs.

Make a tap holder by filing or milling transverse slots near the ends of two pieces of bar stock as shown at right. Drill one piece through and tap the other for a clamp screw.

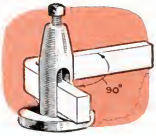


Taps up to ⅜″ can be mounted with the starting taper facing in the direction of carriage movement. Although this brings the back or following edge of the teeth into action, this unworn edge is likely to be sharper than the original cutting edge. Set it at or a trifle below the centerline and, of course, use a lathe feed to match the pitch of the tap teeth.

To use taps having much relief back of the cutting edge, grind the broken end to a taper three or four teeth back and mount with this end in the direction of the feed. In this case the original cutting edge does the work.*—W. E. Burton, Akron, Ohio.*



Auxiliary Bevel Face. On some work, like the bevel-gear blank shown, the stock of a small machinist's bevel will not span a recess, or reach any suitable flat surface from which the angle can be gauged. For such jobs, I made an auxiliary face out of ⅛″ flat steel. This is slotted to let the blade pass through, and countersunk for a small flathead screw, which with a bent clip and a knurled nut holds it on the stock.—*H. Moore, Hamilton, Ont.*



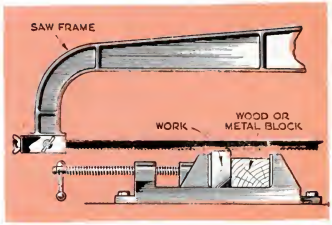
Improvised T Rest. When wood must be turned on a metal-turning lathe, a toolrest for hand chisels can be quickly made this way. Bend an 8″ length of ⅜″ by ⅞″ cold-rolled steel about 2½″ from one end. Clamped in the toolpost, this can be set up to the work with the cross feed and moved along the bed by the carriage hand wheel. It can be turned crosswise for faceplate turning. For light spinning, set in a fulcrum pin. —*F. W. Shelford, Los Angeles.*

Paired Reamers Work Better. When reamers are made up for special jobs, it pays to make two, one the required size, and the other .003″ undersize. By using the small one as a roughing reamer first, you can get smoother and more accurate holes, and the finishing reamer will last longer. Reamers worn undersize can be salvaged by resharpening them for roughing reamers.—*Harold B. Eastman, Cleveland.*

File Puts Bite in Vise. If you have trouble holding round stock in a small vise or one with worn jaws, try putting a piece of an old, coarse-toothed file between one jaw and the stock. The teeth will grip the piece securely with only moderate pressure. —*Dave Findlay, Brooklyn.*

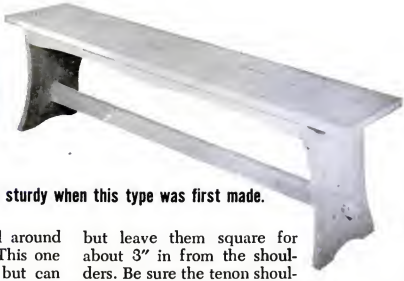
Drilling True. Many drill-press tables are not precisely square with the spindle, a fault that shows up more when thick material is drilled. To compensate for this, old-timers in the toolmaking trade turn the work a little each time the drill bites deeper, until the piece has made a full circle. This is especially helpful when drilling long holes. —*Henry Sevcik, Los Angeles.*

Use the Whole Blade. Many power-hacksaw blades are discarded before their time because only some of the teeth are worn. The reason is that both the work and the saw stroke are usually shorter than the blade, and only the teeth near the work-holding end of the vise come into play. When these are dull, I put a block in the vise as shown below, moving the work back so that the unused teeth bear against it.—*James F. Blizzard, Marshall, Ill.*



How to Build a

New England Bench



Furniture had to be sturdy when this type was first made.

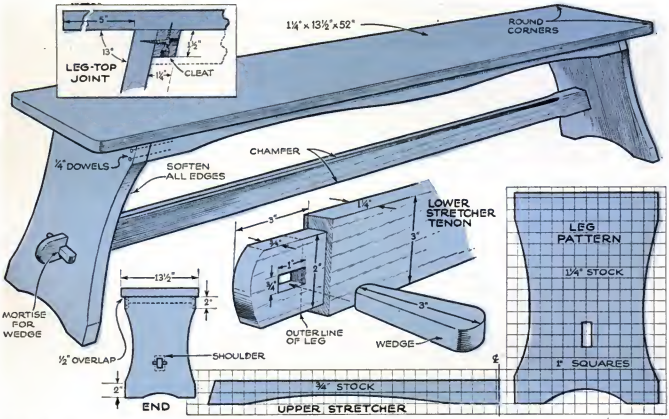
A GOOD bench is always useful around the house, shop, or garden. This one will seat three without crowding, but can be lengthened or shortened to suit. It's a type credited to New England settlers and is as strong as an oak, yet simple—as furniture had to be in those days.

The original was built from clear pine. Cut the top, legs, and cleats first, being sure to get the same 13° angle on top and bottom of the legs and top of the cleats. Chisel out the mortises for the lower stretcher. Fasten the cleats to the insides of the leg tops, flush with them, using 1¾" or 2" No. 10 wood screws, countersunk. Three screws to each cleat are enough. Lay the top upside down on the workbench and fasten one leg, also with screws through the cleats.

Next, cut the lower stretcher, tenoning it at the ends and mortising for the wedges. Chamfer all four edges with a block plane, but leave them square for about 3" in from the shoulders. Be sure the tenon shoulders are also cut to the 13° angle. Insert one end of the stretcher through the mortise in the leg attached to the top, then slip the other leg over the other end and screw to the top. Shape wedges from hardwood and drive home with a mallet, bringing the legs tightly against the stretcher shoulders. Now give the screws that hold the legs to the top a final tightening.

Cut the upper stretchers to shape and fasten them to the underside of the top with countersunk screws in the same manner as the cleats, against which they should fit snugly. Drill two ¼" holes through the legs into the ends of the stretchers and drive in dowels. Cut off the dowels and sand the ends flush.

Use a natural finish of several coats of

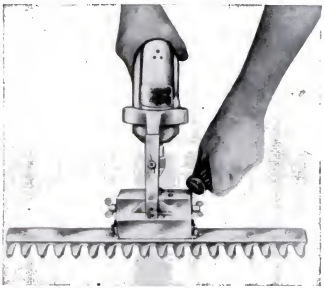


Fit top stretchers snugly against the cleats. Fasten to underside of bench top with screws.

Slip leg over the stretcher tenon before fastening it to the bench top. Wedge holds tenon.

shellac, sanded well between coats, and a final coat of wax. If the bench is used outdoors, a good spar varnish will furnish protection against weather. Should the bench ever loosen up, a tap or two on the wedges will bring it up solid again.—*Roland Cueva, Heyburn, Idaho.*

Garden Tool Run by Electric Drill



THIS interchangeable garden tool is electrified by attaching it to any standard ¼″ electric drill. With a handle grip added, the cutter and drill provide a low-speed hedge cutter. Add a welded-steel carriage and the combination is converted into a high-speed lawn trimmer and edger. It is made by Langtot, Inc., New York City.

Washer Makes Gauge for Countersink

A METAL or plastic washer can be placed under a countersink to insure proper and uniform depth for screw seats. The hole in the washer should be a bit larger than the screw head.—*Melvin Ham, Choteau, Mont.*

Potato Masher Makes Dry-Cleaning Aid

ALL dry-cleaning fluids are rough on the hands. The next time you have a dry-cleaning job, use a potato masher as a plunger to gently force the cleaner through the clothing.—*Will Stoll, Elmhurst, Ill.*

Tune Up Your Tackle

Don't let that big one get away this year because of faulty fishing gear.

By Robert Scharff

PS PHOTOS BY W. W. MORRIS

AT THE end of a fishing day, a rod should be wiped dry with a soft cloth and then gone over with a lightly oiled rag. When you get home, you should assemble the rod and hang it in a cool, dry place. Rods should not be kept in cloth or metal cases. These are for transporting the rod, not storing it.

Before each fishing trip you should inspect your rod. Depending on how much it is used, it may benefit from an overhaul several times a year.

Inspect each section of the rod carefully. Then assemble the rod and whip it, listening for the telltale rattle that means a loose ferrule.

If the guides and ferrules are snug and true, look at the varnished finish. Touch up scratches with spar varnish. But if the varnish is old, checked, and inclined to chip, it will offer little protection to the bamboo. In that case, a complete refinishing job will be necessary.

Cut away the old windings and scrape off the old varnish coat with a razor blade or sharp knife. Don't use sandpaper and don't round the corners of the hexagon section. After the old varnish has been removed, use the back of your knife blade to burnish the bamboo until it shines.

Loose ferrules can be removed by heating them. Scrape all the old cement off the joint. Melt new ferrule cement—it comes in stick form—and apply it to the joint. Heat the ferrule and force it over the end of the joint. When the ferrule has cooled, dip it in cold water. Then scrape off any excess cement.

The guide on the tip of your rod can be tightened in the same way. But be sure to line it up with the other guides.

While you're checking the ferrules, make sure that they fit properly. If they stick because of rust, burnish them lightly with very fine emery cloth.

Ferrules that don't fit snugly can sometimes be corrected with a coat or two of lacquer. But if ferrules are badly worn, it's better to replace them with new ones.

Dirty cork grips can be cleaned with

Windings can be peeled off after cutting them with a razor blade. Then scrape off the old varnish (left) with a sharp knife or a razor blade.

Loose ferrules can be removed (right) by heating them over an alcohol flame. Heat loosens the cement and the ferrules can be slipped off the rod section.

Breaks that don't completely snap rod often can be fixed with glue and small stick. Wrap over stick and rod with cord (above) until glue sets. Then remove cord and bind over break with No. 00 silk. When repairs are completed and windings replaced, you can varnish the rod.

soap and a moist cloth. Wipe the grip dry after washing it. If a metal reel seat is loose, anchor it with ferrule cement. If the reel seat is plastic, use waterproof cement.

A set, or bend, near the rod's tip usually can be worked out by heating it and bending it straight. Don't use a direct flame. Use the heat of an oven. Another way is to hang the tip from a ceiling with a weight attached to the butt of the rod, but this may take some time.

A break that doesn't cleanly snap the rod can be repaired as shown in a photo on the preceding page. Brush waterproof glue over and into the break. Work the break with your fingers so that glue enters all cracks. Place a sliver of hardwood or half a goose quill on each side of the break. Then wrap it with cord. When the glue has set, remove the cord and wrap over quill and break with No. 00 winding silk.

To wrap the rod after all repairs have been completed, you should use windings of the same color and size as the original ones. No. 00 rod-winding silk usually is best for light rods and size A for heavier ones. The drawing shows you how to wind a rod and how to secure the winding. Remember that windings add tension to the rod. Hence, it is important to duplicate their original positions.

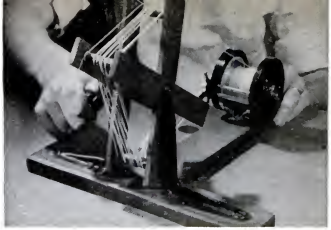
After all wrappings are in place, apply three coats of rod varnish to the rod, rubbing between coats with fine steel wool. Dilute the first coat with turpentine. Flow the varnish on with a heavily loaded brush.

A reel that is cared for properly will last a lifetime—unless you're lucky enough to do a great deal of fishing. Use a good lubricant on spool bearing, handle shaft, click button, free-spool lever, and handle knob, but be careful to add it sparingly.

Sand is the greatest enemy of reels. To clean sand out of a reel, remove the line and disassemble the reel. Wash all parts in a solvent. A small camel's-hair brush helps to clean the gears. Besides oiling the reel after cleaning it, put graphite grease on the gears.

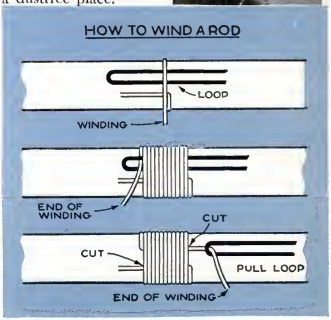
The line doesn't need any attention when used daily. But don't let the line dry on the reel. The line dryer shown at the top of this page will do the job. It can be made from scraps of wood, a couple of shelf brackets, and a bolt for the axle. An old reel handle will serve as a crank.

Dress fly lines regularly with fly-line dressing to make them float. END



A line dryer like this is easy to make and will add greatly to the life of your lines. A line should not be allowed to dry on the reel.

Old trout flies can be salvaged by the simple process of steaming them (above) over the spout of a teakettle. Follow with a spot of lacquer on the head of the fly and it'll be as good as new. To refinish casting plugs (right) use auto touch-up enamel in bright colors. Dry in a dustfree place.



New windings are put on like this. Start by laying loop of line on the rod. Wind over loop. Put end of thread through loop and pull loop and end of thread from under winding.

Ground-Up Rubber Resoles Shoes

YOU can get extra mileage out of your old shoes or rubbers by cementing granulated rubber to the worn soles. The "soleburger" treatment will make many soles as good as new and some better, for the rough rubber bottom gives you an excellent footing on wet or slippery surfaces.

To do the job successfully, you need a high-strength adhesive suitable for bonding rubber and leather. Goodyear's Pliobond was used on the shoes shown being rehabilitated here. Granulated leather or composition soles could be used in place of rubber.—*Walter E. Burton, Akron, Ohio.*

1 Grind up a shoe heel or other chunk of rubber with a rasp. Metal washers, found embedded in some heels, should be removed. Don't use soft or highly elastic rubber.

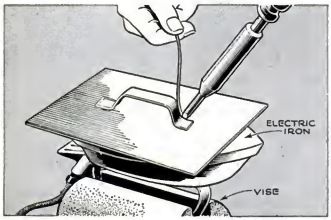
2 Clean the soles thoroughly with a solvent, such as dry-cleaning fluid, and then brush on a coat of cement and allow it to dry. Smooth down and cement any rough parts on sole.

3 When the first coat is dry, apply a second, heavy one. Sprinkle the rubber grit over the tacky surface and press it down. Or you can press the shoe down onto a level pile of grit.

4 Let the sole dry thoroughly, shake off loose particles, and recoat liberally with cement. If you want a thick sole, add a second layer. If not, let dry and sand edges smooth.

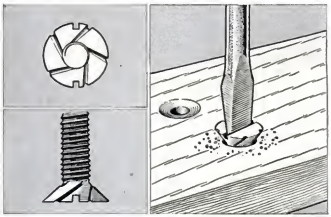
Laundry Iron Preheats Work

THE family iron can make all the difference when you have a job just beyond the capacity of your soldering iron. Clamp the laundry iron in a vise, sole plate up, and lay the work on it. When it's hot, go ahead with soldering as usual. Being preheated, the work won't draw heat away from the soldering area as rapidly, and a smaller soldering iron will serve.—*John Krill, Youngstown, Ohio.*

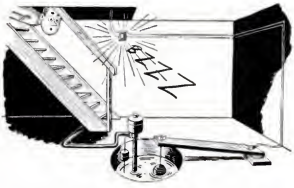


Bolt Makes Improvised Countersink

I NEEDED a countersink for some ¾" holes in hardwood and didn't have one at hand. But with a ¼" stove bolt and a hacksaw I turned out an improvised countersink that worked very well. I used the hacksaw to groove the underside of the bolt head, as shown in the drawing. Then I threaded the altered bolt into the hole with a screwdriver until the hole was countersunk.—*John R. Wilson, Tufts Cove, Nova Scotia.*



My Most Ingenious Solution



I had trouble with water in my basement. So I did the logical thing—installed a sump pump. That was great until the pump began failing from time to time. But now I've rigged up a gadget that warns me when the pump doesn't work. What do you think I did?

Put a copper ball float on a hinged strip of wood. When water in the sump raises the float and strip of wood, a mercury switch on the strip sets off a buzzer. The buzzing lets me know the pump isn't working.—Dr. R. F. Burlingame, Milan, Mich.

Tape Keeps Plaster from Chipping

WHENEVER you drive a nail into a plaster wall, there's always danger of damaging the surface. Stick a bit of cellulose tape on the wall before driving the nail and the plaster won't be so likely to chip.

Lead Permanently Tags Plants

OFTEN it is necessary to tag plants for identification. The lettering on wooden tags frequently is erased by the weather. Malcolm Adams, of East Sandwich, Mass., makes permanent tags of lead. He cuts a sheet of lead into small strips and puts on the lettering with leather-stamping punches. The attaching wire is looped through a hole in the tag.

Cutter Slices Seed Potatoes

SEED potatoes usually are cut by hand, but Ray Baker, of Gratz, Pa., now does it by foot. Pressing on the treadle of his cutting machine quarters each of four potatoes. The pieces then drop through a chute into a basket.

The framework consists of angle iron welded and bolted together. Across the top is a table board with four holes of different sizes to hold potatoes of assorted sizes. Suspended from a bar above the holes are sharp cutters, each with crossed blades to slice a potato into four parts. Tramping on the pedal rams down the cutting bar. A spring raises it.

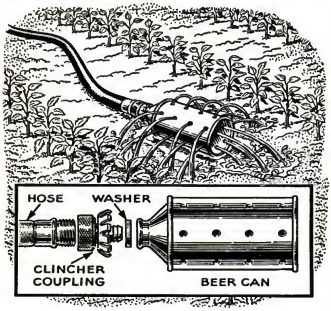
Funnel on Drill Catches Waste

DRILLING into a ceiling or other overhead surface always throws bits of plaster and other chips on the floor—or into your eyes. But if a funnel is slipped over the drill, as shown, it'll catch the waste as it falls.—*R. F. Donovan, Guttenberg, N. J.*

Is Your Drinking Water Safe?

WHEREVER you live, it's advisable to have samples of your drinking water tested occasionally by health authorities. The Department of Agriculture says that few realize the potential danger lurking in defective house plumbing that may allow impurities to enter the water supply.

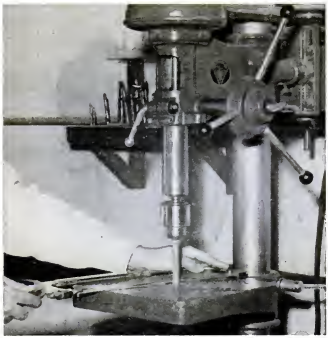
Soak Your Garden with a Beer Can



Here's a new wrinkle for watering your garden with a smooth flow that won't wash away the plants. Punch holes with an ice pick in a beer can of the type shown. Fill the can with small stones. Then clamp a clincher hose coupling over the mouth of the can, using a hose washer to make the joint watertight.—*W. H. McClay, Pasadena.*

Small Pipe Cut Square in Drill Press

Rods or pipe can be cut square by chucking them in the drill press. Let the other end extend through the opening in the table. Lay a hacksaw with the blade flat on the table, as shown in the photo below. Belt the drill at its slowest speed and hold the blade against the pipe with just enough force to keep the teeth cutting as the pipe revolves.—*Melvin Ham, Choteau, Mont.*



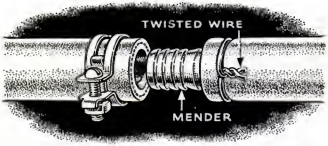
Voltage Regulator for TV Sets

If rises and dips in line voltage cause your television picture to flutter, this voltage regulator may steady the image. It plugs in between the set and the wall outlets and protects the set from burn-outs due to voltage surges. The regulator, made by Clarostat Mfg. Co., Dover, N. H., uses a temperature-sensitive element to compensate for voltage variations. Any rise in voltage increases the resistance of the unit which, in turn, keeps the extra voltage from reaching the set.

Clean Filings Out of New Water Pipes

Metal filings and chips left in newly installed water pipes may damage faucet-seat washers. Before screwing up a new pipe, a good plumber always stands it on end and raps it with a hammer to clear it.

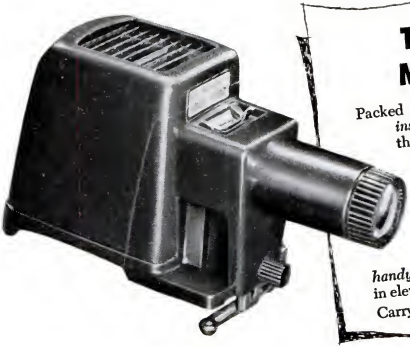
How to Repair Garden-Hose Leak



If a garden hose springs a leak, you can repair it with an inexpensive iron or brass mender available at hardware stores. Cut the hose at the break, as shown in drawing, trim away the bad part, and join the ends with the mender, clamping with wire or clamps.

Deepen Split Faucet-Washer Screw

In replacing a faucet washer, the head of the screw is sometimes so corroded and weak that it splits before the screw turns. If that happens, just deepen the screw slot a bit with a hacksaw. No harm is done if the saw cuts slightly into the old washer. With the slot deepened, you can turn the screw with a small screwdriver.



The Kodaslide Merit Projector

Packed full of features. *For easier slide insertion*—you feed 2 x 2-inch slides through recess in top, remain seated at right of projector—no jarring or moving of instrument. *For even illumination*—Lumenized Kodak Projection Ektanon Lens, 5-inch f/3.5-powerful 150-watt lamp. *For slide protection*—large, cool lamp house keeps slides flat. *For handy elevation*—built-in elevating mechanism.

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Makes superb color slides on Kodachrome Film; sharp black-and-white negatives. Kodak Anaston f/4.5 Lumenized Lens; Kodak Flash 200 Shutter with built-in "synch"; body shutter release; simplified exposure settings marked in red. Takes 8-exposure rolls.

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Projector and screen in a single unit. You need never dim the lights—its projected image, enlarged more than four times, brings out the full beauty of transparencies even in a fully lighted room. Price of viewer, $47.50. Handsome protective case, $14.50.

Prices are subject to change without notice and include Federal Tax where applicable. Consult your dealer.

Kodak
TRADE MARK

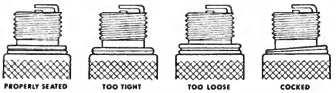
EASTMAN KODAK COMPANY, ROCHESTER 4, N. Y.

Care and Feeding of Engines

BY S. P. CORP

CHECK PLUGS FOR MORE SPARK!

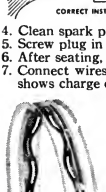
To remove a spark plug that has been in use for some time, blow dirt out of spark plug well, then remove wire and unscrew plug one turn to remove carbon formed around threads. Now tighten plug again and connect wire. Idle engine fast, to get rid of carbon deposits that dropped off bottom of plug when you loosened it. If engine misses, idle until miss is gone. Then remove all plugs and inspect gaskets.



If gasket crease is closed tight, plug was installed too tight, causing a compression leak around porcelain. If gasket is not compressed at all, plug was installed too loosely, permitting leakage around base of plug. If gasket is cocked when installed, results will be the same as with a loose plug. Spark gap will be too high in combustion chamber, causing delayed action, incomplete combustion, and poor gas mileage.

TO INSTALL:

1. Set gap according to your car manual.
2. Always use new gaskets.
3. Clean threads in cylinder head by screwing in old plug without any gasket.
4. Clean spark plug seat in cylinder head.
5. Screw plug in by hand until seated on gasket.
6. After seating, tighten ¾ of a turn with wrench.
7. Connect wires and idle engine. Correct idle speed shows charge on ammeter. Do not idle too slowly.



SPRINGTIME IS RING TIME

If you need a re-ring job, be sure to use Sealed Power Rings—the best rings built! Sealed Power MD-50 Steel Oil Ring is the only ring with the Full-Flow Spring—best for oil control even in badly tapered and out-of-round bores. There is a Sealed Power Ring Set specifically engineered to do the best possible job in your engine! For free booklet, "7 Ways to Save Oil," write Sealed Power, Muskegon, Mich., Dept. H-4.

Gus Teams Up with the Doctor
[Continued from page 192]

wouldn't budge. Again a phone call and a tow back to the same garage. This time the verdict was a broken fuel pump."

"Did they test it?" put in Gus.

"They worked the little lever by hand, and it seemed to run all right to me, but the two mechanics said I needed a new one, so I let 'em go ahead."

"It could have had a broken diaphragm," said Gus.

"Well, anyway, when they were finished, the car purred as good as ever, so we started off once more. But another 200 miles along the line she refused to start again. So, after another tow to another small-town garage the mechanic there felt sure it was sludge in the gas tank that was plugging the fuel lines."

Second Fuel Pump

"Did he blow out the line?"

"They blew the line and they drained the gas tank," grumbled Kinkaid, "without finding a bit of dirt. So, on went another fuel pump. Well, to make a long story short, mechanics at a garage about 70 miles down the road from here put on the third new fuel pump yesterday afternoon. And last night it happened again."

Gus rubbed his chin thoughtfully. "You just didn't happen to save that last fuel pump, did you?" he asked.

"Saved the last two," Kinkaid replied with an emphatic nod of his head. "They're in the trunk."

"Then let's have a look at 'em," said Gus walking around to the back of the car.

Kinkaid unlocked the trunk, reached in behind the neatly stacked luggage, and emerged with two fuel pumps.

Gus took one of the pumps, held his finger over the outlet hole, and began working the rocker arm up and down with his thumb. "This one seems okay," he said placing it on his bench. "Now, let's see the other one."

Pumps Look Okay

"Humph," he grunted as he repeated the test. Then he placed the two pumps side by side on the bench, turning over first one and then the other. Stan and Kinkaid watched as the veteran mechanic compared the two. Finally, with a shrug of his big shoulders, Gus reached up to a shelf on one

[Continued on page 244]

Enjoy both...with one great motor!

IT'S BIG TWIN . . . it's a *new kind* of high-powered motor! *It trolls.* You can ease along at less than 2 miles an hour. For *hours* if you like . . . quiet, smooth, steady! Then—time to get goin'? Flick the Roto-Matic control . . . that's all . . . *and that's plenty!* 25 eager "horses" dig in . . . like a flash you're away on a cloud of foam! And you'll know that something *really* new and wonderful has been added to fishing fun!

SEE YOUR EVINRUDE DEALER . . . and see the motor that's *years ahead!* Lowest weight per horsepower. Gearshift with Neutral, Forward, Reverse. Simplex Starter. Roto-Matic speed control. Big-capacity Cruis-a-Day Tank. And scores of other advancements, all at the *lowest-price-per-horsepower* in modern outboard history!

Look for your dealer's name under "Outboard Motors" in the yellow pages of your phone directory. For full-color catalog of the complete line of 1951 Evinrude models, write

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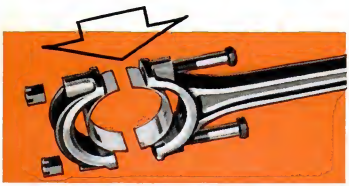
*O.B.C. certified brake H.P. at 4000 R.P.M. PRICES are F.O.B. Factory and subject to change without notice.

HOT BEARINGS *can* FREEZE *the crankshaft*

HARD TO BELIEVE? Not when you consider the two purposes of engine oil—to lubricate, and to *cool*. Badly worn main bearings oil-starve the connecting rod bearings they are supposed to feed. "Shorting" the bearings of necessary oil leads to heat and friction. In the worst cases, bearings overheat and fail—they "freeze" or seize on the crankshaft, causing costly damage.

If your engine is pumping oil, check for worn main and connecting rod bearings. Replace with genuine Federal-Mogul bearings, *engineered* for the job of oil control!



FEDERAL-MOGUL SERVICE
(Division of Federal-Mogul Corporation)

DETROIT 13, MICHIGAN

Gus Teams Up with the Doctor
[*Continued from page 242*]

side of his bench and took down a pressure gauge.

"Just to be sure," he said walking around to the side of the raised hood, "let's give your latest fuel pump a pressure test."

Disconnecting the outlet fuel line to the pump, he substituted the fitting on the pressure gauge. Then, calling to Stan, he said, "Give her a couple of dozen turns with the starter."

Gauge Shows No Pressure

Gus watched the needle of the gauge as the starter churned. The needle didn't budge from zero. "Okay, that's enough," he called to Stan. Then, turning to Kinkaid, he said, "That fuel pump isn't even working."

"But it's brand-new," protested Kinkaid.

"I know," said Gus—"but now let's think back to that timing gear. That seemed to be the beginning of all your troubles. If I remember rightly, you said they had some sort of trouble installing the new one."

"Seemed to me it took 'em hours. I know next to nothing about cars, but I heard one of the mechanics say to the other something about a tight fit and then they began whamming away with a hammer and finally told me it was all fixed."

"Oh, no," groaned Gus. "But maybe we're getting some place. Stan, get that fuel pump off, will you?"

As Stan worked on Kinkaid's car, Gus went back to his bench and studied the two fuel pumps again. When Stan brought over the third pump, Gus placed it beside the other two. "Notice anything peculiar about those pumps?" he asked.

Both Stan and Kinkaid looked and then shook their heads.

Worn Rivets Give Clue

Gus picked up one of the pumps. "Look here," he said pointing to the head of the copper rivet that held the tip of the laminated rocker arm together. It was almost completely worn off. "And the rivets on those other two are worn in just the same way."

Gus put the pump back on his bench. "I think, Mr. Kinkaid," he said, wiping his big hands on a scrap of waste, "we're on the trail of your troubles. If you'll drop back after you've been to the hospital this after-

[*Continued on page 246*]

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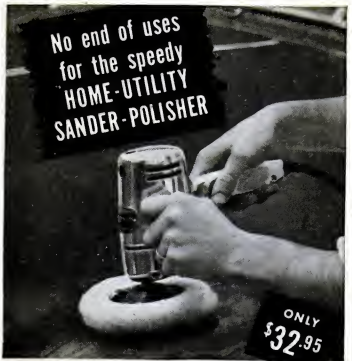

Use it to POLISH YOUR CAR

Use it to SAND DOWN FURNITURE!

Use it to DRILL LEAD HOLES!

Use it for WOOD BORING!

Use it to SHARPEN CUTLERY!

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ELECTRIC
HOME-UTILITY
TOOLS

¼"–½" DRILLS • SANDER-POLISHERS
LECTRO-SAWS • BENCH GRINDERS

Gus Teams Up with the Doctor
[Continued from page 244]

noon I've a hunch we'll be able to tell you what's wrong."

"Blamed if I follow you," Stan said after Kinkaid had left. "That rocker arm on the pump is supposed to ride on a cam on the camshaft, so how could that rivet head on the side of the arm get worn away?"

"That's just it," said Gus, "it *is* supposed to ride on the camshaft, but I'm willing to bet you a broken wrench that these haven't been. I've a feeling the whole trouble goes back to the monkeys who put on that new timing gear. A timing gear is supposed to be *pressed on,* not *blacksmithed* on, and if you do have to use a few taps to get it in place you're supposed to clamp the camshaft so it won't shift."

"Now I'm beginning to get it," grinned Stan. "When they belted the timing gear, the camshaft shifted to the rear just enough so about the only contact the rocker arm made with the cam was on the head of the rivet, and it wore away."

"Brilliant, Dr. Watson," Gus laughed. "Now let's get to work and see if I'm right."

Shortly before five that afternoon, Gus looked up to see Mr. Kinkaid coming through the repair-shop door.

"How's the patient?" asked Gus.

"Wonderful," smiled Kinkaid. "Came through it like a youngster. Doctor Marvin allows how she'll be getting up for a short time each day pretty soon." Then, jerking his thumb toward his car, "Any luck with the other invalid?"

"She'll be as good as new," Gus answered. Then he explained how the hammering on of the timing gear had caused the trouble, and how the worn rivets on the rocker arms had given him his clue.

Wanna Buy a Pump?

"We'll have to install a new camshaft gear, replace a camshaft bearing, and put on one of those fuel pumps," he said. "But by this time tomorrow afternoon she should be ticking them off just about as well as she ever did."

Kinkaid looked at the three fuel pumps lined up on Gus' bench. "Know anyone who'd like to buy two slightly used fuel pumps?" he laughed. "Quite a town you've got here. My wife leaves her appendix and I leave fuel pumps." END

Next Month: Read how to restore your car's original power.

The more you delay - the more you pay!

KEEP YOUR CAR OUT OF THE DANGER ZONE

Watch out for oil-pumping. Usually it means your piston rings are worn. And you're headed for costly Danger Zone 3.

See your motor specialist at once. He'll show you how to get out and stay out of the Danger Zone. He'll show you that replacing piston rings early is relatively inexpensive — but the more you delay, the more you pay.

Replace worn-out rings with Hastings Piston Rings and you *stop* oil-pumping, *check* cylinder wear, *restore* engine performance. It's the best money you can spend on your car.

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FREE! Danger Zone Booklet. It shows you how to save money on engine repairs. Write to Dept. P.

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Jacobs Rubber-Flex Hand-Tite Chuck. One-piece RUBBER-FLEX jaw assembly holds tools true and tight. No loose jaws or springs.

IF IT'S A

JACOBS

IT HOLDS

The Jacobs Manufacturing Company
West Hartford 10, Connecticut

Mechanics of Farming

By Ladd Haystead

■ One man can chop, load, and stack hay at the rate of 100 tons a day by the use of a new stacker-trailer, 28 ft. long, 7 ft. high, 8 ft. wide. Made by Timpte Bros., Inc., Denver, Colo., the stacker is said to reduce costs from about $4.50 a ton to 75¢.

■ Forage grass and legume seeds are now dyed yellow and coated with rodenticide to protect them from both birds and animal pests, reports Dr. Walter E. Howard of the University of California. Birds don't like yellow; rodents avoid the poison.

■ A portable sprayer described as the "world's largest garden hose" (see photo below) has been put to work in Hawaii. The machine delivers 700 gal. per minute and irrigates 12 acres in an 8-hour day with the equivalent of 1.5 inches of

rainfall. Four inches in diameter and 800 feet in length, the hose is uncoiled from a truck-mounted reel. The U. S. Rubber Co. made the hose.

■ This year's wheat crop is threatened by a new fungus known as 15 B stem rust, according to Dr. Elvin C. Stakman, of the University of Minnesota. Last year it ruined 25 percent of the Durham wheat crop in Minnesota and North Dakota and now threatens to spread.

■ A new Westinghouse sun lamp for

DOES 80% OF YOUR WOODWORKING JOBS

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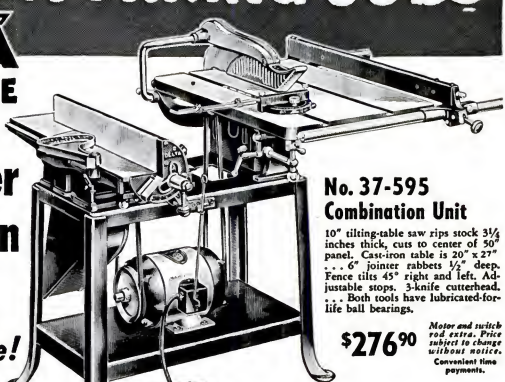

Saw-Jointer Combination

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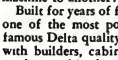
Here's a low-cost, big-capacity Delta 10" saw and a rugged Delta 6" jointer, mounted together on a single steel stand Takes up only 37" x 60" floor space Mobile weight . . . use it in your shop or take it to your job!

Use the two tools singly or double up and work them together . . . one unit keeps two men busy Rip a board then joint it. No fuss with adjustments . . . save time usually lost walking from one machine to another!

Built for years of faithful service. It's one of the most popular units in the famous Delta quality line . . . a favorite with builders, cabinet-makers, woodworkers and in shops of all kinds.



Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

No. 37-595 Combination Unit

10" tilting-table saw rips stock 3¼ inches thick, cuts to center of 50" panel. Cast-iron table is 20" x 27" . . . 6" jointer rabbets ½" deep. Fence tilts 45° right and left. Adjustable stops. 3-knife cutterhead. . . . Both tools have lubricated-for-life ball bearings.

$276.90 *Motor and switch rod extra. Price subject to change without notice.*

Convenient time payments.

Here are some of the accessories that make this saw-jointer a tool of many uses

DADO CUTS UNLIMITED — Delta's Dado Set will straight dado, gain, plough, rabbet, groove, spline cut.

MAKE ALL BASIC SAW CUTS — Cross-cut, miter, rip, bevel, cut-off, double miter, angle rip. Delta offers the right blade for every job!

MAKE THOUSANDS OF SHAPES — The low-cost Delta Moulding Cutterhead Set makes your saw a shaper! And Delta's 27 different Moulding Knife Sets give you thousands of shapes!

See your Delta dealer now!

CUT ODD SHAPES SAFELY — Exclusive Delta clamp attachment on miter gage holds odd-shaped pieces firmly.

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CUT METALS AND OTHER MATERIALS — Cut tubing, bars or sheet — cut tile, brick, plastics, and other materials with proper blade or abrasive wheel

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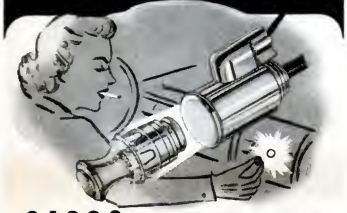

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NO HOBBYIST SHOULD BE WITHOUT ONE!

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only $9.95

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A complete, practical power-workshop for craftsmen, hobbyists! Has accessories to drill, cut, etch, carve, grind, buff, sand, engrave and sharpen — metal, wood, glass, leather, plastic and fibre. 1001 year-round money-saving uses. AC and DC. At Dept., Hardware, Appliance, Jewelry Stores.

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Mechanics of Farming

poultry is claimed to make hens lay more eggs with stronger shells, require less food, and make healthier birds. In an 18-day test period under the lights, hens produced an average of 12.44 eggs, against 9.7 eggs for sun-lamp-less birds.

■ Scotland sends us a machine, the Tullos-Wilmo, that is a one-man grain, clover, or grass-seed planter, a fertilizer spreader, and a duster. The machine, imported by Fuerst Brother and Co., of New York City, has a sowing width of 17' 4", but is convertible to 8' 9" for road transportation by swinging the box around. It has a 2,500-lb. capacity.

■ Fire-protective paint that, when heated, swells into a thick, fire-retarding crust that seals out oxygen is announced by Ocean Chemicals Corp. of America, 1318 S. Kilbourn Ave., Chicago.

■ Electrocution of weeds has been under test for several years. Jesse M. Hodgson, USDA, Meridian, Idaho, reports that one machine, the Electrovator, worked well under ideal conditions, but was not so successful under common field conditions. The current ignited dry stubble and crop residues; too much moisture in soil appeared to nullify effect; some growth appeared 3 to 4 days after treatment; and bindweed survived as many as six treatments.

■ A versatile power tool for farms, called the Kut-Kwick Jr., operates as a saw and a brush and grass cutter. It can also be used to operate a cement mixer, stationary table saw, grinder, crop sprayer, paint sprayer, or grease gun. The device looks like a two-wheel garden tractor, is manufactured by the Kut-Kwick Tool Corp., Brunswick, Ga.

■ Frozen concentrated milk, made by a secret process somewhat similar to frozen citrus juice, has been developed in Florida, according to Chemurgic Digest. The process eliminates curdling. Milk can be shipped cheaply, which might make the process especially useful for milk-less Latin America. Coincidently, National Dairy Products announces concentrated milk that tastes like and has nutritive value of fresh milk.

ELECTRICITY LEAPS from storm clouds to top of Empire State Building as shown in this dramatic night photograph. Engineers harness electrical energy like this to "fire" gasoline in your engine.

Scientists Create "TAILORED LIGHTNING" For Better Motoring

In the great engineering laboratories of The Electric Auto-Lite Company in Toledo, Ohio, a group of Auto-Lite Ignition Engineers have been probing inside engine cylinder walls, peering at "blow-by-blow" spark performances, charting the behavior characteristics of man-made "lightning" across the spark plug gap. From endless tests they've determined what your engine's ignition system needs most, and then set about producing spark plugs to fill the bill. Net result: Ignition Engineered Auto-Lite Spark Plugs . . . the spark plugs that are *world famous* for quality and performance.

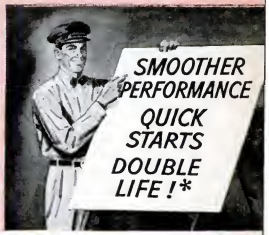
FRANKLIN'S KITE experiment was first demonstration of electrical nature of spark discharges between clouds. Date: 1752.

"FIRING PIN" of the car engine. Your spark plugs fire as many as 15,000 fuel charges per minute with tailored precision.

RELIABLE STARTING is one important benefit resulting from Auto-Lite research to assure correct materials, dimensions and design.

RIVER CUTTING CANYON resembles way surging of electricity wears away electrodes. For solution see next picture.

TINY UNIT called a "Resistor" permits wider initial gap setting, makes possible these advantages of Resistor Spark Plugs:



All car, truck and tractor owners benefit from the exhaustive research performed by Auto-Lite Ignition Engineers . . . the men who design the coil, distributor, spark plugs, wire and all the other parts of the complete ignition system used as original factory equipment on many leading makes of America's finest cars and trucks. *You're Always Right With Auto-Lite.*

THE ELECTRIC AUTO-LITE COMPANY
Toledo 1, Ohio **Toronto, Ontario**

*Double life under equal service conditions when compared to spark plugs without a built-in resistor.

Ignition Engineered
AUTO-LITE
SPARK PLUGS

DREMEL HOME AND SHOP TOOLS

GRINDS • CARVES • ENGRAVES
DRILLS • ROUTS • SHARPENS

DREMEL *Electric* MOTO-TOOL

FASTEST MOST POWERFUL TOOL OF ITS KIND . . . 27,000 R.P.M.

Most practical tool a man can own—more powerful than any similar tool you can buy. Works well in wood, plastics, and metal. For home maintenance jobs you'll wonder how you got along without it. For model making it's a **must.** And for general shop operations it saves time and money. Compare it, try it, buy it. You be the judge! CHECK THESE IMPORTANT FEATURES—Oilless sealed bearings • Dynamically balanced armature • Shock-proof, Bakelite housing • Dust-filtered air cooling system • Sturdy 110-120 V., A.C.-D.C. motor • Wt. only 13 oz. • **A precision tool widely used in industry for many years.**

MOTO-TOOL NO. 2
(with 1 emery wheel point)
$16.50

MOTO-TOOL KIT NO. 2
With 23 Accessories (High-Speed Steel Cutters, Grinding Wheels, Polishers)
$23.50

DREMEL *Electric* COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

MAKE YOUR OWN BENCH JIG SAW

JUST GUIDE IT!

Only $5.85 with 3 saw blades

Plans Free!

SAFE! AS A HANDSAW

For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¾" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only 2 moving parts, never needs oiling. Uses 110-120 v., A.C. Free plans, packed with each saw, for six useful woodworking projects and for making your own bench jig saw.

WHERE TO BUY DREMEL TOOLS

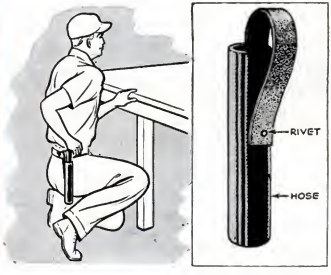
Dremel Tools are sold everywhere. If your dealer cannot supply you, send remittance in full and we will ship postpaid. Or send only $2, and pay postman balance plus postage and fee. **Money back if not delighted after 5 days' trial.**
DREMEL MFG. CO., Dept. 121-D, RACINE, WIS.

Bird Bath Made from Wheel and Lid

When I had to cut down a tree in my garden, I left a stump tall enough to serve as a pedestal for a bird bath. For the bath itself, I used junk. An automobile steering wheel of the flexible type, with the hub assembly removed, made a fine, even base for the lid of a garbage can. I sprung the three spokes of the wheel in place around the stump and fastened them permanently with staples.—*Fred T. Smith, Woodville, Pa.*

Tool Holder Made from Garden Hose

An electrician friend of mine designed an individual holder for his screwdriver so he can carry it on his belt. He used a length of old garden hose, cutting it so a strip of the hose remained to form a loop for his belt. He then bent down the strip and secured it to the main part of the holder with a rivet.—*William B. Eagan, Louisville, Ky.*



"MISTER, YOU SAVED MY DAY!"

"MY SCHEDULE'S TIGHTER THAN EVER THESE DAYS," I TOLD THE MECHANIC, "AND THANKS TO YOU, I'M KEEPING RIGHT ON TIME."

"DON'T THANK ME," HE SAID. "THANK THE GENUINE FORD PARTS I USED IN YOUR FORD. THEY'RE THE REAL TIME SAVER!"

"YOU SEE, GENUINE FORD PARTS ARE RIGHT FOR FORDS — MADE RIGHT TO FIT RIGHT TO LAST LONGER. THEY KEEP YOUR FORD ALL FORD."

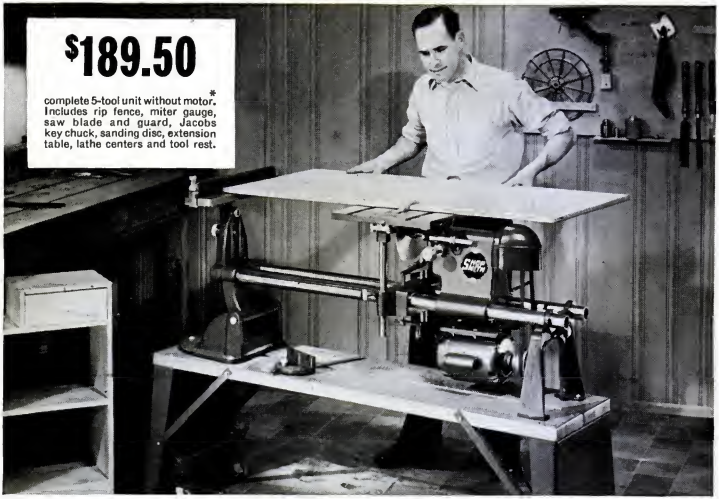
"THEY'RE DESIGNED BY MEN WHO DESIGNED YOUR FORD, TO SAVE YOU TIME, MONEY AND ASSURE REAL SATISFACTION."

"THAT'S WHY YOU'RE SMART TO LOOK FOR THIS SIGN (AT FORD DEALERS' AND SELECTED INDEPENDENT GARAGES) AND ALWAYS SPECIFY GENUINE FORD PARTS"

GENUINE Ford PARTS

AVAILABLE WHEREVER YOU SEE THIS SIGN AT ALL FORD DEALERS AND SELECTED INDEPENDENT GARAGES

THEY KEEP YOUR FORD ALL FORD!



It's SHOPSMITH for ECONOMY

ONE LOW PRICE . . . one compact power unit . . . *five* big money-saving tools—that's SHOPSMITH economy! You save on cost—$300 and up! You save on space—50 sq. ft. or more. You save on the hundreds of things you can make.

And you save *time*—because SHOPSMITH changes from tool to tool in less than sixty seconds; because it features simplified adjustments and *ready-made jigs* for every operation.

SHOPSMITH's "change-ability" does away with the costly duplication of parts, motors, benches. Each part is top quality. The stress-proof steel spindle, for example, has an induction hardened tip; it's machined to watchmaker's tolerances; it floats on *four* grease-sealed ball bearings. *Part for part, job for job, dollar for dollar, you can't buy a finer power workshop.*

See SHOPSMITH and compare! At leading hardware and department stores or at any Montgomery Ward store. And for complete details and specifications, write for your copy of the information-packed, 16-page SHOPSMITH booklet. It's *free!*

**Special SHOPSMITH motor — heavy-duty, ½ h.p., ball bearing, capacitor, 110 V, 60 cycles—$34.50.*

SHOPSMITH Dept. 163-A, *at factory nearest you*
12819 Coit Road, Cleveland 8, Ohio, OR
417 Montgomery Street, San Francisco 4, Calif.

Please send me the free SHOPSMITH booklet.

*Name*_____

*Address*_____

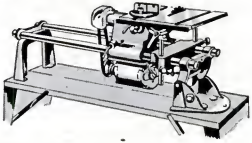
*City*_____ *State*_____

SHOP SMITH

16-page illustrated booklet brings you complete information about SHOPSMITH *—America's largest-selling power tool.*

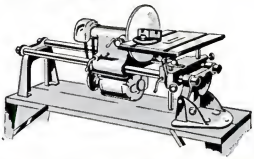
SHOPSMITH AS AN 8-INCH CIRCULAR SAW

Large-capacity saw with blade to fence distance up to 48 inches. You can cut to the center of 8-foot plywood panels. 2¼-inch depth of cut. Large miter gauge with automatic stops every 15°. Self-aligning rip fence with front and back locks.



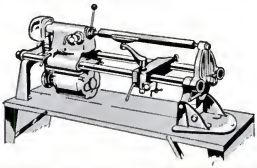
SHOPSMITH AS A 12-INCH DISC SANDER

In less than a minute you can convert SHOPSMITH to a disc sander second to none. Extra-large, tilting table. Miter gauge and rip fence provide accurate, convenient jigs. Unique micro-quill adjustment lets you feed disc into work.



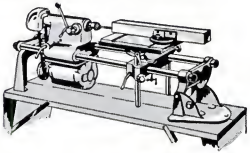
SHOPSMITH AS A 33-INCH WOOD LATHE

Turns table legs, lamp bases, bowls up to 15 inches in diameter (4 inches more than most heavy-duty lathes), 33 inches in length. Tool rest slides parallel to work, requires fewer adjustments. Speeds from 800 to 3600 rpm. Rigid, tubular ways, stress-tested at over a ton.



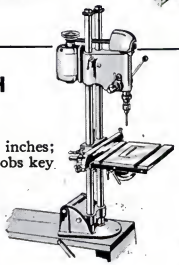
SHOPSMITH AS A HORIZONTAL DRILL PRESS

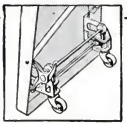
It's new! It's practical! It's extremely useful! Performs drilling operations too awkward or bulky for a vertical drill press. Handles work of unlimited length. Makes an easy job of dowel-jointing boards for table tops or wide shelves.



SHOPSMITH AS A 15-INCH VERTICAL DRILL PRESS

Table to chuck clearance, to 27 inches; floor to chuck, to 55 inches. Jacobs key chuck takes drills up to ½ inch. Variable speeds. 4-inch quill feed. Stress-proof spindle floats on *four* grease-sealed ball bearings.





NEW RETRACTABLE CASTERS

They increase SHOPSMITH'S already great flexibility. Easily mounted on any wood or metal bench. Easy to set, too, with three-stage foot levers that raise or lock unit. Your SHOPSMITH dealer has them. Complete assembly . . . $11.95

Gigantic "Warehouse Remodeling"

MAIL SALE

SAVE up to 70%!

Check these bargains:

We Pay Shipping Charges

POWER PLANTS AND GENERATORS

- **Army Homelite Power Plant:** 1500-w. 115-v. 60-c. New condition. Guaranteed. While they last $259.50
- **Homelite 115-v. 1400-w. 400-c. Light Plant.** Complete. New. With tools, parts, manual. Ideal for lights, heaters, radio—campers, contractors, etc. Cost Gov't $645. $129.60
- **Power Plants,** all types. 300-w to 25 KW. Write for listing or send requirements. All guaranteed.
- **D-C Arc Welder.** 0-250 amps. Drive with tractor, engine, etc. Ready to use. Built-in controls, reactor. Brand new $99.50
- **Build Welding Generator.** Delco-Remy. 200 amps. 30-v. Full instructions. Includes control, fan, etc. Cost $296 ..... $29.89

(Power plant bargains—500-w to 25 Kw.—write)

WINCHES, CLUTCHES, TRANSMISSIONS, ENGINES

- **Gas Engine.** 2-cycle, 1 h.p. Finest design $28.60
- **Gas Engine.** Briggs 1.5 h.p. Model N $36.90
- **Power Winch.** 81-to-1 ratio, 5000-lb. capacity. Mounts on front trucks, jeeps, cars. Cost over $175 ..... $24.95
- **Hand Winch.** Finest steel. Powerful. Complete with 3,000-lb. 50' cable. 1 to 3 ratio $29.95
- **Same Winch.** dual ratio 1-3, 1-9 ..... $39.50
- **Winch Snatch Block.** 5,000 lb. cap. Roller bearings $5.50
- **Utility Clutch.** Engine end takes 1" shaft. Drive end, 3/4". Handles engines or motors up to 6.5 h.p. $13.95
- **V-Belt Clutch.** 1/2", 5/8" or 3/4" shaft size. Up to 1.5 h.p. ..$7.50
- **Speed Reducer.** Drive at 1750. Gives any speed 0 to 450 RPM $19.95
- **Pulley Clutch.** 3 h.p. 4½" pulley, easy release. A steal ..$7.95

Special! **FLEXIBLE GUY and TURNBUCKLE UNIT**

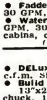
New 12-ft. 48-strand, 1/4" galv. steel cable, 1000-lb. strength, 14-in. turnbuckle. Guy strengthen ... gates, fences, buildings, wagons, television towers, etc. Cost Gov't $1.10 each.
Special—10 for $3.89
50 for $16.47; 100 for $29.32.

WATER PUMPS AND SYSTEMS

- **Bronze Rubber Rotor, All-Purpose Water Pumps.** Stainless steel shaft. Pipe thread. Self priming. High efficiency.
  1/2", up to 25 PSI, up to 6 GPM $12.75
  3/4", up to 25 PSI, up to 10 GPM $18.95
  1" up to 25 PSI, up to 19 GPM $22.95
- **Bronze Nylon Roller Pressure Pump.** Stainless steel shaft. Pipe thread. Self priming. Positive displacement.
  1/2" up to 100 PSI, over 3 GPM $14.50
  3/4" up to 150 PSI, over 8 GPM $20.95
  1" up to 150 PSI, over 17 GPM $27.95
- **Low Cost Centrifugal Pump,** over 15 GPM ...$6.85
- **Hi-Efficiency Cent. Pump.** Garden hose thread, over 15 GPM. Complete with pulley $11.95
- **Fadden Centrifugal Pump,** bronze, stainless steel shaft, 3/4x1/4", 30 GPM, $8.80; 1x3/4", 42 GPM, $37.60; 1 1/4"x1", 60 GPM $46.50
- **Water System.** Automatic, finest 110-v, 60-c motor, 22' lift, 300 GPM, 30 lbs. Fresh water instantly. Complete. Easy to install. For cabins, cottages, farm homes, etc. $69.50

(Write for free pump circular. Give details your problem.)

AIR COMPRESSORS AND SPRAY EQUIPMENT



- **DELuxe Air Compressor.** Pressures to 150 lbs. Capacity to 8 c.f.m. Single cylinder, 2" bore, 1.75 stroke $20.50
- **Build Your Own Compressor.** 1-cyl. piston compressor, stainless 13"x25" tank, 160-lb. gauge, paint spray gun, blow gun, tire chuck, 15' hose, fittings and manual $39.90
- **Stainless Steel Air Tank,** brand new, not used, 13"x25". 400 lbs. $8.95
- **Brass Check Valve,** (dash pot non-chatter type) $3.75
- **Brass Adjustable Pop Off Valve,** 25 to 250 lbs. $1.98
- **Automatic Pressure Regulator** (0 to 150 lbs.) $2.49
- **Automatic Pressure Motor Switch,** on 115, off 150 lbs. ...$5.87
- **Finest Pressure Gauges** (air or water) specify pressure, 100, 160, 300 lbs. $1.99
- **DeVilbiss Air-Solvent Engine Cleaner,** $14.95 ..... $8.96

(Write for paint spray equipment bulletin)

WELD SPRAY UNIT

- All-brass 14-foot boom, 4-row, tee jets, bronze direct-drive gear pump, gauge, relief, shut-off, strainer, fittings, etc. Cost $139.50 ..... $74.65

MECHANICAL—ELECTRICAL—ELECTRONICS

- **Rural Phone.** Magneto, 5-bar, 2500-ohm, wall type $12.40
- **Private Phone.** Magneto, desk, many uses $11.60
- **Acro Saw.** Fits on any 1/4" drill, cuts full 1-15/16" ..... $ 7.95
- **Army Switchboard,** 12-line, small hotels, factory, etc. $33.50
- **Phone Insulated Wire.** Twisted pair, outdoor type (100-ft.) ..$ 1.39
- **Stone Job Lot.** 12 finest Norton wheels, 1" to 4" ..... $ 1.89
- **Mounted Stone Job Lot.** 4 mounted stones, 1 wire brush (1/4") $ 2.19
- **Rotary File Kit Lot.** (1/4") 6 Assrt. tool steel units ..... $ 3.26
- **Electric Water Heater.** 5 1/2 gal. 110-v. 1200-w. Guar. $49.50
- **Tractor Wheel Spray Unit.** Complete, 17 lb. outfit $17.50
- **Motor** 2 H.P. 24-v. D-C. Double shaft. 4000 RPM $10.89
- **MotorGyro.** 24-v. D-C. 10,000 RPM. Fascinating! ..... $ 1.98
- **Oil Pressure Gear Pump** (supercharger type) new ..... $ 4.95
- **Parts Cabinet.** All steel. 4 drawer. 16 compartments ..... $ 2.78
- **Precision Hand Level.** With leather case ..... $ 7.95

(Hundreds other electrical—radio—mechanical—tool bargains.)

ORDER DIRECT FROM AD

Write for Free Catalog!

FREE CATALOG

BURDEN SALES COMPANY

826 "O" ST. LINCOLN, NEBR.

Plastic Desks Defy School Kids

THE high cost of repairing and replacing school desks has caused the Wilmette Public School in Illinois to start using a new type of desktop that's said to be virtually indestructible. Made by the H. R. Winton Co., of Chicago, it consists of a laminated-wood core with a melamine-resin surface that kids can't chip, peel, or carve with a knife. Marks from pencils, crayons, and pens are wiped off with a damp cloth.

Musical Bicycle Horns Play Tunes

SOMETHING new for small speed demons are these musical horns for mounting on tricycle, bike, or wagon. Made of Tenite plastic, the Melodee Trio sound three notes, allowing a child to play simple tunes by squeezing the rubber bulbs in the right order. The set, including a swivel mount, is made by Waljohn Plastics, of Brooklyn.

Replace Your Winter-Weary Spark Plugs with new

CHAMPIONS

BE A CHAMPION DRIVER . . . *New Spark Plugs now insure better performance all Summer*

Old, winter-weary spark plugs make engines sluggish and wasteful. Dependable new Champions do just the opposite!

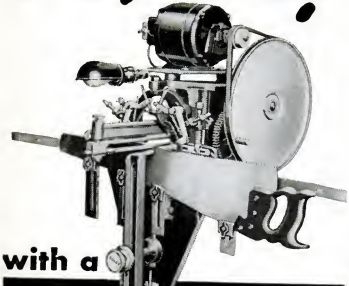
As an important family utility your car deserves regular care. Give it new Champions now for better performance all summer!

More motorists replace with Champions than any other make—America's favorite spark plugs for over 25 years!

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

Last Year's Profit $3,000!



with a

FOLEY *automatic* SAW FILER

"Last year's profit amounted to $3,000. Not so bad for a one-man outfit"—from Chas. C. Hough. James B. Williams wrote us—"I made $765 last year filing saws, and it sure comes in handy. I do this work in my spare time." Men in communities of all sizes make up to $2 or $3 an hour with the Foley Saw Filer working full time or part time. That extra money comes in mighty handy in these days of high prices.

It's no trick to take care of the saw filing for your neighborhood hardware or lumber dealer—plus looking after the saws for farmers, townspeople, manual training departments and factories. The Foley files all hand saws, also band and cross-cut circular saws. It's a cash business, no canvassing, no eyestrain and no experience needed.

FREE BOOK SHOWS HOW TO START

"INDEPENDENCE AFTER 40" shows just how you can start at home in your spare time working in your basement or garage. It's an immediate cash business that can develop into a full-time repair shop. Send coupon today—no salesmen will call.

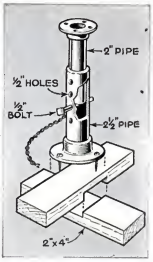
Send For **FREE BOOK**

FOLEY MFG. CO., 419-1 Foley Bldg.
Minneapolis 18, Minn.
Send me free book **"INDEPENDENCE AFTER 40!"**

Name.....

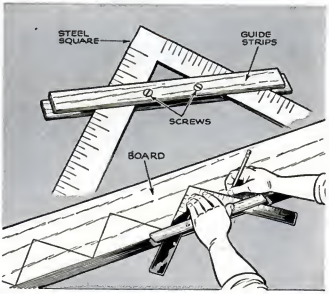
Address.....

Supporting Perch Made from Pipe



Two pieces of pipe, two pipe flanges, and two pieces of two-by-four are all you need to make this handy, adjustable support. I've found such perches useful for holding up pieces of farm machinery when I have a repair job to do, and for storing machinery up off the floor.

Dimensions may be varied to suit your purposes. The ones I made have 2½" pipe, 12" long, for the lower part and 2" pipe for the upper part. Half-inch holes were drilled at 2" intervals through the 2½" pipe. A ½" bolt holds the jack at the desired height. The base was made from two pieces of two-by-four, 12" long, that were half lapped at the center.—*Ralph S. Wilkes, Keuka Park, N. Y.*



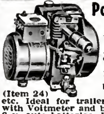
Guide Keeps Stringer Angles Alike

Two guide strips clamped to a steel square as shown will enable you to mark stringers for steps so that all angles will be alike. Place the tightened guides against the edge of the board and the square will give the angle.—*Hugh Lineback, Stillwater, Okla.*

Collapsible Tube 100 Years Old

First collapsible tube, forerunner of tooth-paste and shaving-cream containers, was patented in 1841. Collapsible aluminum tubes, however, weren't made in America until 1920.

BUY DIRECT-BRAND NEW-UP TO 85% DISCOUNT



Portable LIGHT PLANT

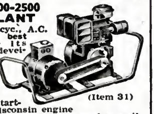
PUSH BUTTON START

500-700 watts 110-120 v. — 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1¾ hp. gas engine. No wiring necessary, just plug in and operate. Plenty of current for most oil burners, emergency lights, freezer, radio, incubator, etc. Ideal for trailers or camping. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. **Be prepared if war or storm knocks out power lines.**

(Item 24)

Reg. $275.00 value............ **$143.50**

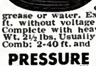
GIANT 2000-2500 WATT PLANT



(Item 31)

110-120 V. 60 cyc., A.C. **Absolutely the best** made because its heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted—portable. Powered by 5 h. p. easy starting Briggs or Wisconsin engine —complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. $585.00. Special at.... **$299.50**

GENERATOR ONLY and control box. Drive it with your engine or tractor **$169.50**



EXTENSION CORD

(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet amazingly flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Usually $4.50—Special 40 ft. **$1.99** Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**

PRESSURE SWITCH

(Item 30) Penn Electric Model 110 BPO2, best made. For pumps and air compressors. Heavy duty. Will handle up to 250 lbs. press. and up to 5 h. p. Autom. unloader valve, for easy starting. 110-220 v. A.C. or D.C. 2 pole. Wt. 5 lbs. Reg. list $17.50. Our Spec. **$9.45.**

HOT WATER HEATER

(Item 26) Immersion type, heavy duty, 115v. A.C. 300w. Does not require watching. Thermostat shuts off at 165°. Keeps water hot for shaving, washing dishes, etc. Also good for keeping water from freezing in big troughs or tanks. Made by Cities Service. Wt. 4 lbs. Worth $9.50. Our Spec. **$4.50.**

CLIP BOARD

(Item 17) Heavy Masonite, with self-adjusting spring hinge to hold up to 100 sheets of 8½x 11 paper. Push back cover for instant release. Flip cover shut and notes or drawings are protected. Perfect for pilots, engineers, students, artists, truck drivers. Wt. 2½ lbs. Usually $2.95. Spec. **$1.10, 2 for $2.00.**

GAS ENGINE

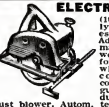
(Item 25) Air-cooled. 1½-2 h.p. Complete with gas filter, air cleaner, governor, fuel tank. Ready to run. Speed range 2000-3600 r.p.m. ⅝" shaft. Rope start. Ideal for pumps, air compressors, power tools, generators, etc. Factory warranty and instructions incl. One of the best made. Wt. 40 lbs. Worth $72.50. Special.......... **$46.50**

GAUGE TESTER

(Item 27) Precision made of solid bronze by Star Brass Co. Calibrated weights (incl.) acting against hydraulic piston, provides quick accurate testing of all pressure gauges up to 3000 lbs. per sq. in. Brand new in hardwood cases. Wt. 100 lbs. Reg. $435.00. Our Spec...... **$135.00**

HYDRAULIC HOSE

High pressure, heavy duty, complete with swivel fittings. Pipe thread connections. Ideal for farm equip., bulldozers, grease guns, airbrakes, etc. Any length. Minimum $1 per lgth. INSIDE DIAMETER, ¼" **50¢** per ft. ⅜" **60¢**, ½" **80¢**, ⅝" **90¢**.



ELECTRIC HAND SAW

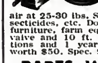
(Item 36) Most perfectly balanced and smoothest running saw made. Advanced design provides max. power and light weight. Easily adjusted for all angles, depth and width of cut. Comes complete with 6¼" comb. blade, ripping guide and 10 ft. hvy. duty cord. Built-in sawdust blower. Autom. telescoping guard. 110-120 v. AC-DC. Depth of cut 2⅛". 1 year written guar. Wt. 12 lbs. Drastically reduced.............. **$39.95**

ANGLE DRILL

(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. **Operates at any angle in a full 360° arc.** Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck (¼" capacity) and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at $39.95—while they last..... **$9.95**

CARRY-AIR

(Item 32) Stainless steel tank—capacity 500 cu. in. at 400 lbs. press. complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 13 lbs. Worth $20.00. Our price.......... **$8.95**



SPRAY OUTFIT

(Item 37) Twin cyl. piston type compressor direct-connected to powerful 110-120 v. AC-DC motor. Built-in air tank eliminates pulsation and provides steady flow of air at 25-30 lbs. Sprays lacquers, enamels, insecticides, etc. Does beautiful work on autos, furniture, farm equip. 1 qt. spray gun, relief valve and 10 ft. air hose incl. Full instructions and 1 year guar. Wt. 11 lbs. Easily worth $50. Spec. **$22.95.**

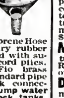
PARTS WASHER

(Item 20) Store gas or carbon tet. in 5 gal. safety can. Valve releases just the right amount into washing compartment. Parts are washed and drained on a "dunking" screen — no fishing for parts. Eliminates fire-danger, waste, spillage, evaporation. Wt. 14 lbs. Reg. $19.50—Special.... **$5.95**

FIRE EXTINGUISHER

(Item 39) Fully charged (at 1,000 lbs. P.S.I. or more) with CO2 (carbon dioxide), the proven miracle fire fighting chemical that smothers oil, gasoline and electrical fires. Play safe; keep one in your car, garage and home. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. REFILLABLE at nominal cost. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. $19.50 value. Special.................... **$6.95**

5 GAL. STRAINER FUNNEL



(Item 28) Made of heavy galv. steel. Fine brass strainer built into neck. Perfect for straining milk, gas, diesel fuel, spray mixes, etc. Wt. 7 lbs. Worth $5.95. Our Spec. **$2.25, 2 for $3.95.**

RUBBER HOSE

New genuine Neoprene Hose — outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections, included. **Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil.** Save more than 60%.

(Inside Diam.)	1¼"	1¼"	1½"
Length	25 ft.	40 ft.	30 ft.
Price	9.25	14.75	14.75

If specified we will send special hose for gas or oil at same prices.

AIR HOSE

(Item 11) ¼" Diam. heavy duty, double braid, suitable for gas stations, spray painting, air tools, etc. 20 ft. with standard swivel couplings. Wt. 4 lbs. Reg. $6.50 val.—only **$2.95.** Five 20 ft. lgths. (100 ft.). Wt. 20 lbs. Only **$13.75.**

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lb. **$6.35;** 9" Fan, wt. 6 lbs. **$7.45** 10" Fan, wt. 7 lb. **$8.45;** 12" Fan, wt. 8 lbs. **$9.45.**

½" DRILL

Removable handle

(Item 33) DeLuxe model —powerful, smooth running, precision built. Handles toughest jobs. Cutler-Hammer switch, **Jacobs** key chuck. 110-120 v. AC-DC 300-450 rpm. Alum. alloy case for high strength and easy handling. Built-in blower assures cool operation. Cap. ½" in steel. 1 year written guar. Wt. 11 lbs. Should be $65. Special.......... **$34.50**

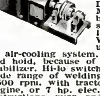
¼" DRILL

(Item 34) Hi-power, long-life, smooth running. Alloy steel gears; built-in blower. Cutler-Hammer switch. **Jacobs** hand-tite chuck. 110-120 v. AC-DC 1000-1600 rpm. Cap. ¼" in steel. 1 year guar. Wt. 4 lbs. Terrific value at **$12.95.**

38 Pc. DRILL KIT

(Item 35) Includes above illus. guar. drill, buffers, polishing bonnet, sanding discs, grinding wheels, wood bits, steel bits, wire wheels, bench stand, paint mixer burrs. Complete in heavy steel case. Wt. 13 lbs. 38 pc's., all highest quality. Complete kit worth $38.50. Our Spec. only... **$19.85**

HEAVY DUTY ARC WELDER



(Item 38) Use as portable or shop welder. 250 amps, D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to ½" plate using ¼" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 10 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs. A $400 value at............... **$99.75**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.......... **$8.50**

FRAM OIL FILTER

(Item 12), Model F21, Big 73 cu. in. size. Ample capacity for all cars, trucks, tractors. Universal bracket, standard openings. Fram filters are tops. Easy to install. Wt. 8 lbs. Usually $7.95—now **$3.75**

MANUFACTURERS SPECIALS

RHEOSTATS (Item 40) variable load, 480 kw total capacity, up to 440 v., AC or DC, arranged in 80 substeps of 6 kw each to provide instant selection of any power output desired. Controlled by magnetic contactors; remote control possible. Ideal for testing setup, group starting, frequency control, variable speed, etc. Made by Cutler Hammer. Brand new. Worth $4000. Only 2............each **$1100**

MUD CHAINS (Item 43). Extra heavy for dual truck tires, 7.50x20, triple side links, made by Intl. Chain. Reg. list $57.50— our spec.......................... **$19.50**

DUCT FANS (Item 42) Amer. Blower Co.; powerful 24" 3-bladed fan mtd. in circ. steel duct which tapers from 25" to 30" diam., 16" hi. Duct flanged for easy installation. Fan powered by 1 hp. 115 v. DC motor, 1150 rpm. Tremendous output. A $20 Cutler Hammer starter control incl.; also big steel tool box, spare armature, bearings, brushes, etc. Easily worth $195; a terrific value at.............. **$39.50**

READY POWER GAS-ELECTRIC PLATFORM TRUCKS (Item 41) 5 ton capacity; platform 90" long, 40" wide, 17" hi. Powered by Chrysler eng. Equipped with coupler for trailers; very maneuverable; used but in exc. operating condition. Will ship on approval to well-rated firm. New price $4000— our special **$1350**

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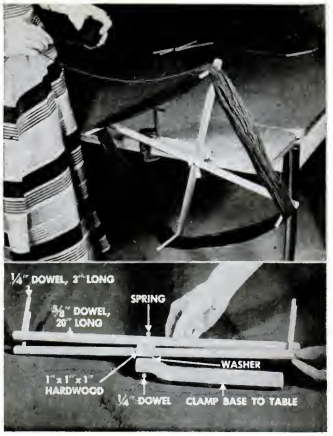

Yarn Reel Folds Flat for Storage

QUICKLY made from dowels and a couple of scraps of hardwood, this yarn reel can be clamped to a table for use and folded for storage. A cotter pin through each end of the ¼" dowel that serves as a shaft holds the assembly together, and the spring helps keep the main arms at 90°. Set the 3" pins into the arms at a slight outward angle to keep the yarn from slipping off.—*Benj. Nielsen, Aurora, Neb.*

Scrubbing Renews Sandpaper

SANDING belts, disks, drums, and sheets often lose their bite long before the grit is worn off. Cleaning will make them almost as good as new. Dip a stiff scrubbing brush in turpentine or kerosene and brush out the clogging gum and pitch. Some papers can be cleaned several times.—*E. P. Alexander, Jr., Plymouth, Mass.*

Repairing Leaks in Plywood-Boat Hulls

WHERE joints in the hull panels of plywood boats develop a leak, flow thinned marine glue into the opening and refasten the joint with new screws driven into new holes. Damaged areas of plywood hulls can be repaired by cutting them out and fitting a "dutchman" or filler block of plywood of the same thickness. Back the patch with a larger piece. Use glue between the dutchman and backing and fasten with screws.

GROBANS' WAR SURPLUS SPECIALS

ALL BRAND NEW — FULLY GUARANTEED

LOGAN HEAVY DUTY

HYDRAULIC PUMP

For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications. Delivers 10 GPM at 1200 RPM at 1000 P.S.I. using 5 HP. Has a ¾" inlet, ½" outlet, ¾" shaft with the key-way for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ships wt. 22 lbs. Overall dimen. 7" L x 5½" H x 5½" W. A 105.00 value FOR ONLY **22.50** F.O.B. Chicago

(Item #29)

BYRON-JACKSON "PUP"

CENTRIFUGAL PUMP UNIT

AT LESS THAN ½ PRICE

2 Stage Model "PUP" Pump Driven by an 8 Cylinder Model C-36 Chrysler Industrial Engine.

IDEAL FOR: Pick-up, Gathering, Fire Fighting, Salt Water Disposal, Sprinklers, Irrigation, Dewatering, Construction, etc.

Engine Speed
2400 RPM—100 HP
600 GPM at 175 PSI
—Parallel Connection
300 GPM at 375 PSI
—Series Connection

These skid-mounted Pumping Units are standard production models with parts and service readily available. Designed for a wide range of operating conditions particularly where wide variation in head and capacity are required. Twin suction and discharge ports are cast on the same side and so arranged that external piping is interchangeable for either parallel or series pumping applications. Overall dimensions, 114"L x 29"W x 62"H. Weight 4060 lbs. Now, complete with operating instructions and performance data ONLY ..... **$1495.00** F.O.B. Chicago

(Item #132) **Present Value $3000.00**

GENERAL MOTORS-ALLISON

CENTRIFUGAL PUMP

200 GALLONS PER MINUTE

- For Draining Basements
- Fire-Fighting
- Irrigation
- Fuel Transfer
- Swimming Pools
- Home Water Systems
- Dewatering

This General Motors-Allison Centrifugal Pump—designed for use on U. S. Air Force Mustang fighters, now converted for commercial, home, and industrial high volume pumping applications. Inlet, 3½" standard pipe thread, twin outlets with 1¼" pipe thread, ball bearing supported ¾" shaft. Easy, fast simple priming. Rotation, counter-clockwise facing shaft. Shipping wt. 35 lbs. Gov't acq. cost $145.00. F.O.B. Chicago. Now Only **39.50**

(Item #130)

Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	75'	260	6.0	3500
10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

new! HYDRAULIC SPEED REDUCER WITH FINGERTIP CONTROL

FILLER PLUG — CONTROL HANDLE — REVERSE BUTTON — CONTROL LOCK — INPUT SHAFT — OUTPUT SHAFT

USE FOR: ● Reamer Drives ● Midget Cars ● Feed Mills ● Canning Machines ● Conveyors ● Lathes ● Milling Machines ● Motor Boats ● Cream Separators ● Garden Tractors ● Pumps ●

Variable output speeds ranging from 0 to approx. 1/3 speed of input shaft. Merely move control handle until desired speed is attained. Then turn locking handle to maintain the setting. Internal relief valves prevent overloading. Use input power of ½ to 1½ H.P.

This Westinghouse-Oil Gear Unit converted to commercial use from 40 MM anti-aircraft traversing mechanisms consists of a variable displacement hydraulic pump feedbac a fixed displacement hydraulic motor. These components are contained in a crackle-finish steel oil reservoir (capacity 2 qts.). Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Both input and output shafts measure ⅝" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speeds not to exceed 750 R.P.M. Overall dimensions 7½"x7½"x11½". Gov't. acquisition cost, $428.00. Shipping weight 26 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago **54.50**

(ITEM #115)

NEW! STATIONARY OR PORTABLE

D.C. Arc Welder

250 AMPS. MODEL 252 (ITEM #251)

FOR ANY WELDING JOB
LIGHT OR HEAVY
STOP COSTLY REPAIR BILLS.
WELD IT YOURSELF AND SAVE.

Only one or two jobs will pay for entire welder. Designed for many years of trouble-free service. This precision-engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run wear on 2500 R.P.M. from drive pulley or power take-off of tractor, a 7½ HP electric motor or a 10 HP gas engine. Use two V belts or flat belt on pulley). Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. F.O.B. Chicago **99.50**

Now at a fraction of its value

new! STATIONARY OR PORTABLE

FOR ANY WELDING JOB
LIGHT OR HEAVY
STOP COSTLY REPAIR BILLS.
WELD IT YOURSELF AND SAVE.

Only one or two jobs will pay for entire welder. Designed for many years of trouble-free service. This precision-engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run wear on 2500 R.P.M. from drive pulley or power take-off of tractor, a 7½ HP electric motor or a 10 HP gas engine. Use two V belts or flat belt on pulley). Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. F.O.B. Chicago

Now at a fraction of its value

Hydraulic Cylinders-Air or Oil

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

ITEM #1—Tractator hydraulic oil filter. Permanent element type, ¾" female pipe thread ports. Capacity, 16 gallons per minute. A $13.00 value. Now **Postpaid** **4.95**

ITEM #4—All steel double action hydraulic cylinder. 1½" bore, 3⅞" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs. **Postpaid** **4.95**

ITEM #33C—Double action hydraulic cylinder. 1½" bore, 4½" stroke. Clevis mountings at both ends. Uses ¼" pipe fittings. **Postpaid** **8.95**

ITEM #32—Double action. 1½" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $45.00 value. **Postpaid** **10.95**

ITEM #16C—Double acting hydraulic cylinder. 1½" bore, 26" stroke. Will lift 1760 lbs. with 1000 PSI line pressure. Weight 8 lbs. A **16.95** $55.00 value. Now Only. **Postpaid** ....

ITEM #1—Double acting hydraulic cylinder. 2½" bore, 17" stroke. Clevis mounting. Will lift 4900 lbs. with 1000 PSI line pressure. ¼" diam. shaft. ⅝" tubing thread ports. Overall length closed 28". Shipping wt. 11 lbs. F.O.B. Chicago **21.50**

ITEM #31C—Double action hydraulic cylinder. 3½" bore, 1" stroke. Aluminum cylinder wall and all steel 1¼" piston rod. Clevis mounting at base and shaft. 19¼" overall length closed. Will lift 9925 lbs. using 1000 PSI from Logan Heavy Duty Hydraulic Pump. Uses ⅝" tubing fittings. Value $102.00. Shipping wt. 11 lbs. F.O.B. Chicago **22.50**

ITEM #6—Double action hydraulic cylinder, 3" bore, 24" stroke, will lift 7070 lbs. with 1000 PSI line pressure. Steel barrel, 1¼" stainless steel shaft. Gov't acq. cost $176.00. Shpg. wt. 26 lbs. F.O.B. Chicago **28.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 PSI line pressure is 12,500 lbs. Ship. wt. 30 lbs. F.O.B. Chicago. An excellent buy for **32.50**

(Item #42)

DIRECT CURRENT GENERATORS

For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #131—Brand new Electric Auto-lite 12 volt Direct Current electric generators, rated 18 amps. Complete with blower and pulley. Use for trucks, tractors, boats, battery chargers, etc. Part No. GEF-4805A. In original sealed U. S. Army cartons. $40.00 value. Shpg. wt. 27 lbs. F.O.B. Chicago ... Now Only **15.00**

Item #90—Type P-1, rated 200 Amps.—28 Volts, 2500 RPM. Mfd. by General Electric, Ford, Delco-Remy and Westinghouse. Gov't Acq. Cost $300.00. Shpg. wt. 70 lbs. F.O.B. Chicago **22.50**

Item #91—Type R-1, rated 300 Amps.—30 Volts, Mfd. by Jack & Heintz. Gov't. Acq. Cost $380.00. Shpg. wt. 70 lbs. F.O.B. Chicago—Each individually packed in wooden box **35.00**

(Item #129)

AIRCRAFT WOBBLE PUMP

Type D4—Bronze and aluminum construction. ¾" pipe thread inlet and reversible pressure utility hand pump. May be used as a sump pump, barrel pump, fuel transfer pump, etc. Shipping wt. 7 lbs. F.O.B. Chicago **11.95**

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Speed Way
Speed Sander
$34.50

Sands, Cleans, Smooths, Polishes Electrically

Designed for industry, for professional work, this light, beautifully balanced, orbital-motion, SpeedSander is rapidly becoming a standard home appliance. With its powerful electric motor and all-ball-bearing construction, anyone can easily re-surface and refinish furniture, woodwork, metal surfaces or walls. It will quickly remove old paint, stain, or enamel down to the bare wood or metal; will sandpaper to a "piano finish"; remove rust and corrosion or "feather edge" a scraped fender. It will burnish pots and pans or with lambs wool bonnet, delicately polish fine furniture. It makes tedious, tiresome jobs fun—saves hands! In design, convenience and efficiency it is today's finest sander regardless of price. Ask your local dealer to demonstrate it. *Write for Catalog*

Speed Way MANUFACTURING CO.
1864 So. 52nd Ave., Cicero 50, Illinois

best white tape made
ONLY 98¢*

The new "Evans White-Tape" has everything you'll find in tapes costing over $1.50—plus.

- snow-white blade with bold, legible, jet-black numerals and graduations. Graduated in 32nds for first 6 inches.
- sturdy die-cast case heavily chrome-plated, calibrated for quick reading inside and outside measurements.
- blade ½" wide made of finest high carbon steel—tempered—Bonderized—enamelled—baked.
- blade replaceable in seconds—without tools—without even opening case. And Evans replacement blades cost far less.
- every "Evans White-Tape" is unconditionally guaranteed.
- exclusive Evans automatic brake gives smoother push-pull action with absolutely no "creeping" of tape into case.
- underside is white, too. Mark with ordinary pencil, remove mark with flick of thumb.
- unheard-of low price*: 10-ft. $1.49; 8-ft. $1.19; 6-ft. 98¢. Prices higher in far west and Canada.

Sold only through retailers.

Evans & CO. • Newark 5, N. J. ® 7429

Makers of Evans 6-ft. Folding Rule and Folding Yardstick

Giant Pipe Siphons River Water

THE 25-foot-diameter pipe seen above crossing an eastern Washington canyon is really part of a giant irrigation canal. The Soap Lake Siphon carries over 4,000,000,000 gallons of water daily from the mighty Columbia across the Lower Grand Coulee to bring life-giving moisture to over a quarter million acres of once-arid land. The walls of the concrete pipe are 23 inches thick and are reinforced with quarter-inch steel plates.

Pad Protects Gardeners' Knees

GARDENERS would be less likely to have sore knees if they had this Kneel-On apron. A foam-rubber pad is attached to the bottom and snaps up out of the way when not needed (left). Large utility sections and smaller pockets hold tools and supplies. Made of washable burlap by Paul Products of Portland, Oregon, it sells for $3.95.

SURPLUS MACHINE SHOP TOOLS AT PRICES YOU CAN AFFORD

HIGH SPEED MORSE TAPER SHANK DRILLS

SET 1M 20 Different Size High Speed Morse Taper Shank Drills from 1/4" to 1". $70 Value. Priced at only..... **$12.95**

SET 2M 10 Different Size High Speed Morse Taper Shank Drills from 1/2" to 1 1/4". $50 Value. Priced at only..... **$9.95**

SET 3M 7 different size High Speed Morse Taper Shank Drills from 1" to 2". with No. 3, 4, and 5 tapers. At least 3 drills over 1 1/2" in size. $125 value, only..... **$29.95**

HIGH SPEED TAPER SHANK CHUCKING REAMERS

SET 4M 15 Different Size High Speed Morse Taper Shank Chucking Reamers up to 1 1/2" with No. 1 and 2 tapers. Priced at only..... **$6.95**

SET 5M 8 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/4" to 1". Priced at only..... **$4.95**

SET 6M 10 Different Size High Speed Morse Taper Shank Chucking Reamers from 1/2" to 1 1/4". $65.00 value. Priced at only..... **$9.95**

SLITTING SAWS

SET 7M 7 Different Size High Speed Slitting Saws 2 3/4" dia. x 1" arbor. Thickness from .040 to .071. Cuts wood, aluminum, brass, steel, etc. $25 Value. Priced at only..... **$4.95**

HIGH SPEED HAND TAPS

SET 8M 8 Different Size High Speed Standard Thread Hand Taps up to 3/4" including 2 std. High Speed Pipe Taps **$2.95**

HAND REAMERS

SET 9M 10 Different Size Hand Reamers from 1/4 to 1". Majority brand new, only **$7.95**

SET 10M 20 Different Size Hand Reamers as above, only..... **$13.95**

BRAND NEW HIGH SPEED COMBINATION DRILL AND COUNTERSINKS

SET 11M 8 Different Size from C2 to M1 (1 1/16" drill x 13/64" body to 3/8" 7/32" drill x 3/8" body) 60 degree of Countersink. These New Countersinks Sell New from 75c to $2.50 each. Your price for this set of 8, while they last. only..... **$3.95**

BRAND NEW MOUNTED STONES

SET 12M Mixture of 1 2 Stones with 1/4" Shanks. Only **$2.75**

BRAND NEW CUT OFF WHEELS

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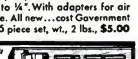

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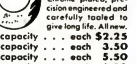

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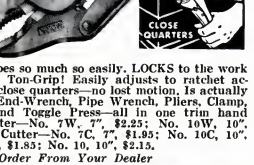

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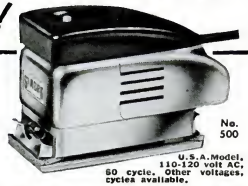

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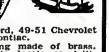

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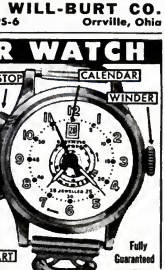

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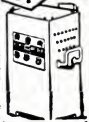

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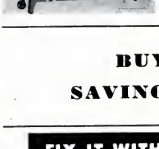

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SUPER COMBO MIX – No. SC2. Here's a real bargain. All eleven above mixes for ONLY **14.95**

REAMER MIX – No. 168. Reamer assortment: Special Taper line finish Reamers. High Speed Steel. Slightly used but in excellent condition. Ten assorted sizes ranging from .168x.165 & .244x215 to .425x.385 & .432x.403. One alone worth our selling price of ten. For set of ten Reamers . . . **4.49**

FLEXIBLE CABLE

Rust resistant alloyed steel, extra flexible, pre-formed – 7 by 19 strand-on reels.

1/16"	4½¢ ft.	7/32"	9¢ ft.
5/64"	5¢ ft.	1/4"	10½¢ ft.
3/32"	5½¢ ft.	9/32"	11½¢ ft.
1/8"	6¢ ft.	5/16"	14¢ ft.
5/32"	6½¢ ft.	3/8"	15½¢ ft.
5/16"	8¢ ft.	1/2"	18¢ ft.

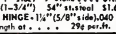
Stainless Steel – Not pre-formed

1/8" . . . 9¢ ft. 1/4" . . . 31¢ ft.

Bronze Cable – Not pre-formed

1/16" . . . 5¢ ft. 3/16" . . 23¢ ft.
1/4" . . . 17¢ ft. 1/2" . . . 38¢ ft.

PIANO HINGE



Overall Width		Length	Price Ea.
1¼"	(5/8" side)	72" alum.	$1.00
2"	(1" side)	9' alum.	$1.75
3½"	(1-3/4")	54" st. steel	$1.69

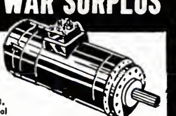
BRASS HINGE - 1¼" (5/8" side) .040 Any length at . . . . 29¢ per ft.

Order from this Ad. All sales final. All Prices F.O.B. Los Angeles. Pay by M.O. or Check. P.O.'s Accepted from D&B firms. ½ deposit with C.O.D.'s.

PALLEY SUPPLY COMPANY
6321 SAN FERNANDO RD.
DEPT. PS-4 GLENDALE 1, CALIF.

SAVE UP TO 85% IN WAR SURPLUS

NOW! MAKE YOUR OWN ARC WELDER



Here's a Real Buy! Finest precision built R-1 Generators, used on B-29's, cost the Government approximately $400.00. Gives from 300 to 400 amps at 27 volts. Ideal for all welding, light and heavy up to 5/8" thickness. FREE complete instructions for conversion of this Generator to welding unit. R-1 NOW AVAILABLE AT **27.95**

Other AIRCRAFT GENERATORS

P-1	27 Volts	200 Amps	15.95
1273-1A	27 Volts	75 Amps	15.95
E-5A	12 to 15 Volts	50 Amps	12.95
03	27 Volts	100 Amps	25.00

NEW! GEAR HEAD MOTOR

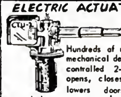
GHM-607 – Originally designed to drive large Aircraft Tow-Target reels. Powered by 24 VDC, 95 amp, compound wound motor. Rated at 2 HP. Turns 4,200 RPM and is geared down to 136 RPM at the power take-off shaft. 60 foot pound torque at take-off. Power drive is 3/4" female adaption. Unit has magnetic clutch for instant stop control. Comes complete with operating switches and control box. **37.50**

FIRE EXTINGUISHER

Kiddie Lux CO_2 Type. Built to Gov't. spec. Shatterproof, heavy case, Full-re-charged. With horn.

No. 602A – 7½ lb. $35 val. **19.25**
No. 603 – 10 lb. $65 val. **25.95**
No. 601 – 4 lb. Wheel control type **14.25**
No. 605B – 15 lb. Wheel control type **32.95**
No. 605C – 15 lb. Squeeze Grip type $85 val. **39.95**

ELECTRIC ACTUATOR



Hundreds of uses for any mechanical device needing controlled 2-way action, opens, closes, raises or lowers doors, windows, gates, valves.

CTU-2 Foote linear actuator. 24 Volt A.C. or D.C., 8500 R.P.M., 1/6 H.P. Series wound motor, 4½" stroke in 13½ seconds. Compression and tension Loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall length retracted 11" Only **6.95**

TACHOMETER – TYPE C-11

Operates on direct drive with flexible shaft. Range is 0 to 4500 RPM. Ideal for use on single engine planes or boats, autos, etc. Drives direct from camshaft or at 2 to 1 reduction from crankshaft. **$4.75**

AUTO PULSE PUMP – Ideal for fuel pump for auto or boat. 24 Volt D.C. Can be adapted to 6 Volt D.C. 1/8" standard pipe ports **5.50**

TWO HEAT SOLDERING IRON

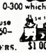
World's Hottest Iron Value!

Two soldering irons in one with button heat control. Push the button—Select 150 or 300 Watt heat for light or heavy work. Complete with tip, bench holder, 5' asbestos cord. U.L. approved. 110V AC. A $15.00 Value For . . . **3.95**

D.C. METERS

AMMETERS		VOLTMETERS
- 30 - 0 - 30 +	0 - 120	0–30 $4.95
- 60 - 0 - 60 +	0 - 240	
-120 - 0 - 120 +	0 - 300	

Your choice 3.95 ea.



COMBINATION VOLTMETER - AMMETER
30V – 30 AMP
30V – 60 AMP **$4.95**

All meters 2" face except 0-300 which is 3" face.

SHUNTS - Required for use with D.C. Ammeters 30–60–120–240
SOLD ONLY WITH METERS. **$1.00**

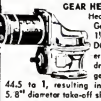
LEAR ELECTRIC MOTOR.

24 volt, 6 amps, series wound reversible motor with overload clutch. Motor turns 11,000 R.P.M. Has 11 to 1 gear reduction box turning 1000 R.P.M. at take-off. Adaptable to flex or rigid drive. Limit switch box. Size 10" x 4". **$7.95**

SAMSELL MOTOR

27 volts, 16 amps 1/5 H.P. reversible, series wound on motor. 3800 R.P.M., shaft 9/32" diameter, 12-spline. 4-1/8" x 2-3/8". ONLY **3.95**

GEAR HEAD MOTOR



Heavy Duty G.E. Gear Head Motor. 1½ H.P., 24 volt DC, 125 amp reversible motor will drive reduction gear box unit 44.5 to 1, resulting in 168 R.P.M. at 5/8" diameter take-off shaft. Motor contains electro magnetic break.

UNIT COMPLETE **10.95** MOTOR **4.95**
GEAR BOX ALONE **7.95**

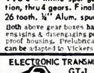
NEW ELECTRIC MOTORS

No. 500 – New ½ HP – 27 Volt DC-AC. This motor can be readily adapted to deliver up to ½ HP on 110 Volts AC by the simple method of rearranging armature brush-leads. Free diagram with each order. A sensational Value **$5.95**
No. 500-A – Converted to 110 Volts-AC Equipped with plug and 3½ ft. Heavy Duty Cord **$8.49**

GEAR BOXES

VTG-1 – 90°. bevel gear 1½ to 1 reduction, size 7" x 6". A Lifetime Value. **$3.95**
VTG-2 – Inline spur gear 16 to 1 reduction, thru 4 gears. Final take-off 4½" dia 26 tooth. ¼" Alum. spur gear. . **$6.49**
Both above gear boxes have lever control for engaging & disengaging positive clutch. Dust proof housing. Prelubricated bearings. Both can be adapted to Vickers Transmission.

ELECTRONIC TRANSMISSION GEAR TRAIN



GT-1, approx. 50 Bronze Spur & Pinion Gears – 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm and worm gear drive sets, 40 N.D. ball bearings ½" to 1½" dia., watch springs, bushings posts, face plates, housings–Micro Switches, 2 miniature controlled clutches, etc. Gears in multiple size & sequence, identical teeth ratio, giving 100's of gear reduction combinations. Wt. 19 lbs. **8.49**

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PACKED WITH BARGAINS!!!! Just Off The Presses! Bigger Than Ever! 200 Pages of NEW and SURPLUS Clothing, Tools, Camp Equipment, Electrical Supplies, Hydraulics, Motors, Pumps, Valves, Raw Stock, etc. AT UNHEARD OF LOW PRICES! Send 50¢ Today! (refunded with your initial order of $1 or more).

HYDRAULIC CYLINDER SPECIAL

Gives 20,000 lb. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery, presses, etc. Cost Gov't $390.00 **29.75**

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for information.

No. 9-E HYDRAULIC CYLINDER

Double action cylinder. Has a bore of 1-3/8" and shaft of 1". Stroke is 9" Overall length 15¼". Built for 1500 lbs. continuous duty, 3000 lbs. intermittent duty. Will lift or push up to 2300 lbs. Can be adapted to hundreds of jobs. NOW **8.95**

No. 3 HYDRAULIC CYLINDER – Double action. Bore is 1". Shaft ½". Has a stroke of 2½ to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. **4.75**

FOUR WAY VALVE

V28 Poppet type. Valve shuts off at neutral position. Has 3/8" AC Tube Ports – 9/16 – 20 thread. Will stand 1500 PSI. . **4.75**
V-17 – Poppet type, pressure balanced. Has piston with built-in relief valve to limit cylinder strokes. ½" std., pipe inlet & outlet ports. ½" AC tube to cyl. (¾" x 18 thread). **8.75**

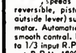
STRATO POWER PUMP

With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. 2 gal. per min. cap. at 1500 RPM at 1250 PSI. Pressure limit 1250 PSI continuous, 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent max 4500 RPM. Rotates either direction without adj. **19.50**

GEROTER TYPE PUMP

Logan Geroter type. For operating hydraulic systems on trucks, tractors, etc. Delivers 8 GPM at 1200 RPM at 1000 PSI with 5 HP. Can also be used as Hydraulic fluid motor. 3/8" stand pipe ports, 1/2" splined shaft for pulley or direct attachment. 5½" dia., 7" long. Used but condition guaranteed **21.50**

VICKERS HYDRAULIC Transmission



Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output R.P.M. - 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. **32.50**
4" Spline Shafts for input & power take-off . . . **2.50 PR.**

New improved woodworking calculator

answers countless questions in seconds . . . speeds jobs!

Here's the *improved* GREENLEE Calculator with more information on lumber, nails, concrete mixes, painting materials, etc. Convenient . . . simple to read. Just set dial for nail specifications, to convert linear to board feet, find bit sizes for screws, compare characteristics of wood. 6″ diameter, heavily varnished card-board, printed in three colors. Special offer by the makers of famous GREENLEE tools.

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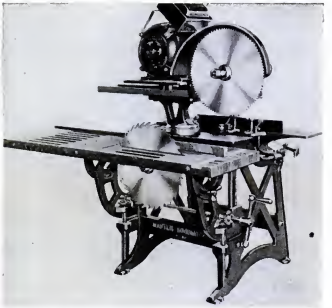
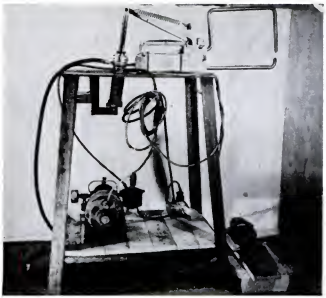
New



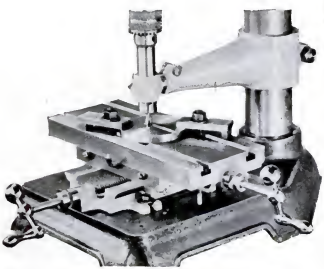
Twelve Machines in One. Here are the jobs you can do with this machine: crosscut, rip, miter, compound miter, rout, tenon, bevel rip, plow, joint, bore, shape moldings, and cut off and dado in one operation. It's made in eight models by the Master Woodworker Manufacturing Co., of Detroit. The smallest is operated by a ½-hp. motor. The largest one is run by a 7-hp. gasoline engine. Prices run from $240 to $850.

Guide for Portable Electric Saws. This guide converts a portable saw into a precision tool that accurately duplicates cuts. With it you can miter and bevel miter, crosscut and bevel crosscut, rip and bevel rip. By use of extension rods, the unit can be set up to cut large panels. The guide is manufactured by U-Bee Sales Company, of San Francisco.

Tools



Air Operates Spot Welder. Both your hands are free to handle the work when you use this welder. Foot pressure on the pedal at right of the stand closes the contacts. Toe pressure from the same foot then triggers the spot weld. Air at 30 pounds pressure is required. Sun Heating Co., North Hollywood, Calif., is the maker.



Milling Attachment for Drill Press. The bracket clamped to the column supports the cutter spindle of this milling table where support is needed most—close to the cutter. The bracket can be swung out of the way when not in use. The bronze spindle bearing is adjustable for wear and has an automatic oil-feed system. Waterborg Machine Company, of Racine, Wis., is the maker.

Get Your POWER KING Saw

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"America's Finest 8" Saw Value"

POWER KING 8" TILT/ARBOR SAW

ONLY . . . $61.75 !

F.O.B. Kalamazoo, Mich. Price includes motor rail, belt, pulley, mitre gauge, fence, splitter, guard — less motor.

BIG! FAST! RUGGED! ACCURATE!

Steel is scarce! Don't delay a day longer in buying a good, dependable power saw for your shop. This fine Power King 8" tilt/arbor model is today's outstanding buy. It's priced low, has every feature you need for "factory-quality" work in your home shop. Pays for itself on shelves, cabinets, cupboards, furniture, home repairs.

POWER KING 7" TILT/ARBOR SAW

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F.O.B. Kalamazoo, Mich. Price includes same as above, less motor.

"KING OF THE 7" SAWS"

No other 7" saw even close to this value! *Big capacity — big saw features* — yet priced so low it pays for itself on one or two projects alone! Fast, accurate, lasts a lifetime. See these fine saws today at your Power King dealer's, or send postcard for details.

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UTICA MagneKit

Here's a special set of 3 top quality tools that will do just about any GRIPPING job that comes along. Having the RIGHT tool *speeds* the task, improves the result.

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A wonderful gift for any home owner, hobbyist or workshopper.

NATIONAL HARDWARE WEEK—APRIL 12-21

Visit your IRHA hardware store for gala offerings and special values—among them the Utica MagneKit—an outstanding value at only $5.85. Bought separately, the items would cost $7.24.

Utica Drop Forge & Tool Corporation • Utica 4, N. Y.

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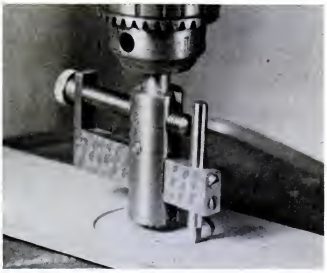
Address Desk 154 **OREGON SAW CHAIN CORP.**
8816 S. E. 17th Avenue, Portland 2, Oregon

New Tools

New Punch Press. This four-ton press has a 12¾" throat and a 400-lb. cast frame. Another feature is a drive dog built into the clutch collar instead of a slot in the crankshaft. This was developed to eliminate weakening the one-piece shaft by deep milling. The trip mechanism lets the operator shift from single to continuous operation without stopping the press. The maker is Kenco Mfg. Co., Los Angeles.



Circle Cutter. The size adjustment on this tool works on the screw-thread principle, allowing accurate setting to any hole diameter within the tool's range. Maximum hole diameter is 4" for one model and 6" for another model. The Precise Measurements Co., of Brooklyn, N. Y., is the maker.

This One

X77K-3XP-1ZS0

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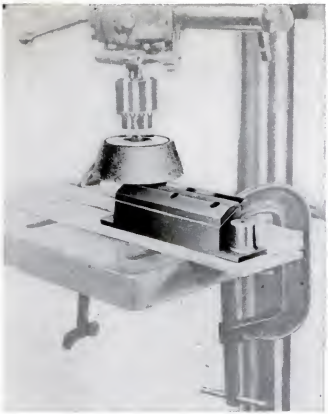
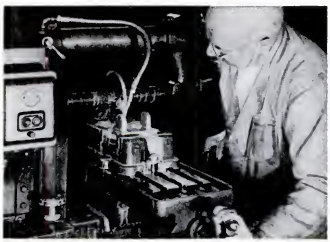


Jig Sharpens Jointer Blades. In use, the jointer knife is placed in a groove in the jig. This holds the knife at the proper angle for sharpening. With a cupped grinding wheel chucked in a drill press, you just pass the jig under the wheel several times to sharpen the blade. The knives are accurately reinstalled in the head by the use of a gauge built into one end of the jig. The unit, including grinding wheel and arbor, is priced at about $13 by the Hartmeister Manufacturing Co., Denver.

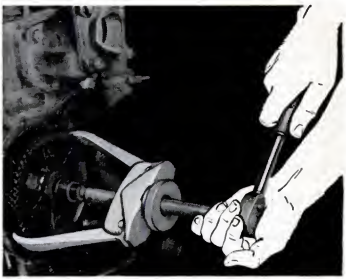


Gooseneck Coolant Spout. This spout is adjustable to any position and it will stay in place without support. It eliminates leaky pipe joints and swivels and it can be easily switched from one machine to another. The manufacturer is the J. N. Fauver Company, Inc., of Detroit.

on some jobs

a man's just GOT *to have*

pull



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Save hours of mean, hard work! Avoid broken, distorted, battered, burred, ruined parts! Do better work quicker, with easy-action Snap-on Gear Pullers, favorite professional "taker-offers" in thousands of shops. They'll ease off 'most any keyed, splined, pressed, sweated-on, shrunk-on or rusted-on part—gently, without damage. Save muscles! Save costly parts! Save time! Build a reputation for skilled, *professional* work! Snap-on Gear Pullers are beautifully made, of tough alloy steels—varied sizes and types—small, medium, large (4½, 8½, 14-inch spreads) up to 20-ton power—screw, slide-hammer and combination types—wide choice of jaws, adaptors, attachments. If you are a user of quality tools, send for free 104-page catalog. *Snap-on Tools are not sold in stores.* Buy from your Snap-on man or order from factory.

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P.S. Last minute news & notes...

POPULATION of the U.S. is estimated now at 153,000,000--2,000,000 more than when the census was taken last April. The death rate last year was the lowest ever recorded--about 9.6 per 1,000 population. But motor vehicle fatalities rose from 31,500 in '49 to 35,000 in '50. Nearly as many Americans have now been killed in auto accidents as in all the wars that this country has ever fought.

THE WINNER of the 1950 Wright Aeronautical Trophy, Grover Loening, an engineer and inventor, expects the 1970 airplane to "cruise 1,200-1,500 m.p.h., be externally much quieter, land almost vertically, be built largely of titanium, have an auxiliary engine for taxiing . . . have landing gear suitable for either land, snow, or water . . . and above all . . . be fireproof in crashes."

TETRAETHYL LEAD, which now must be conserved for defense needs, will be produced by a new continuous process in a plant being built by du Pont. It is expected to help meet the demand for high-octane fuel . . . A PILL to turn water into champagne has been patented by a Frenchman. It is a capsule of sugar and bicarbonate of soda containing alcohol.

JET-PROPULSION principles apparently are applicable to stationary furnaces. Researchers say that heat may be released faster by a series of detonations than by combustion. They are designing industrial furnaces in which gas will be exploded rather than burned.

POWER-LINE engineers trying to develop 500,000-volt lines have found that rain, sleet, and fog are formidable foes. Up to 80 times as much power may leak away when a "wet blanket" covers such a line as does when the weather is fair . . . COAL BURNED UNDERGROUND is a feasible source of electric power, say Bureau of Mines experts who have been doing it experimentally in Alabama . . . A PIPE LINE for coal is to be built in Ohio. The coal will be crushed and pumped for 17,000 feet through a 12-in. line.

TELEPHONE POLES now are being made mildly radioactive. The movement of preservatives in the wood is being traced with hot atoms of strontium --in the hope that ways can be found to make the poles last longer . . . HIGHWAYS will soon be studied similarly. Rutgers engineers have found a way to measure the density of soil beneath paving with a cobalt isotope.

MOST TV SETS made this year will have "intercarrier" sound systems--one intermediate-frequency system for both picture and sound. RCA and Du Mont, however, are sticking to the more elaborate separate-channel system. RCA expects to reduce the amount of cobalt in a TV receiver 90 percent by using electrostatic picture tubes and redesigned loudspeakers.

THE COMETS, Britain's new jet air liners (PS, May '50, p. 98), probably will fly mail from England to India before they haul passengers. They will fly about 200 m.p.h. faster and 15,000 ft. higher than most of the big air liners now being used . . . AN ATOMIC ENGINE for an airplane is being designed now, preliminary research having indicated that it is feasible.

THE AVERAGE CAR now costs its owner $861 a year--as compared to $815 a year ago--American Automobile Association figures indicate. That includes, insurance, depreciation, gas, tires, upkeep, etc. . . . A PLASTIC SEPARATOR developed by Exide is expected both to conserve scarce materials and prolong battery life.

The Editors

"MARFAK MADE HIS CAR RIDE SO CUSHIONY HE'S SPOILED"

That "cushiony" feeling lasts far longer—with *Marfak* chassis lubrication. *Marfak* is scientifically compounded to resist jar-out and squeeze-out. It *clings* right to vital chassis points when the going's wet. *Marfak* lasts 1,000 miles or more! Today, get *Marfak* lubrication from your Texaco Dealer, *the best friend your car ever had.*

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Precision Lathes

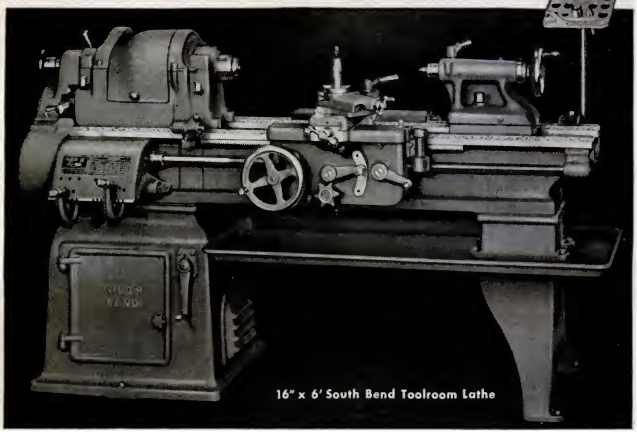
For Better Machining

Whether you are doing production, maintenance, service or experimental work, you have need for South Bend Lathes. They produce better machining efficiently — especially when close tolerances are specified. Consequently, their use often results in appreciable savings in machining costs. And, being reasonable in price, they do not require heavy capital investment.

South Bend Lathes are your best buy. They're designed right — built right. Check coupon for complete information.

Building Better Tools Since 1906

SOUTH BEND LATHE
SOUTH BEND, INDIANA



16" x 6' South Bend Toolroom Lathe

SPECIFICATIONS OF SOUTH BEND 16" LATHES

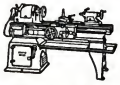
Swing: 16¼" over bed, 9⅝" over cross slide.
Bed Lengths . . . . . 6 to 12 feet
Center Distance . . . . . 33½" to 105½"
Cross Slide Travel . . . . . 10½"
Spindle Speeds:
8-Speed Drive . . . . . 25 to 770 r.p.m.
12-Speed Drive . . . . . 20 to 945 r.p.m.

Collet Capacity . . . . . 1"
Spindle Bore . . . . . 1⅜"
Power Feeds:
Longitudinal: 48 R.H. or L.H., .0015" to .0841"
Cross Feeds: 48 . . . . . .0006" to .0312"
Thread Cutting: 48 R.H. or L.H. pitches . . . . . 4 to 224 per inch

Send Information Checked:

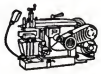
☐ 16" TOOLROOM LATHES
☐ 16" QUICK CHANGE GEAR LATHES
☐ LATHE ATTACHMENTS

☐ 9" and 10" BENCH LATHES



☐ 10" TO 16-24" FLOOR LATHES

☐ 14" DRILL PRESSES



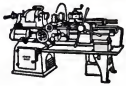
☐ 7" BENCH SHAPERS

Name_____

Street_____

City_____ Zone_____ State_____

☐ TURRET LATHES ½" and 1" Collet



SAVE GAS . . Up to 1 Gallon in Every 4

Up to 35 Miles Per Gallon

install a

MILE-O-METER

(Reg. U.S. Pat. Off. International Copyrights & Patents Secured)

(measures miles per gallon)

and motor tune-up gauge

Mile-O-Meter is a gasoline mileage gauge as well as a motor tune-up indicator, very important in running your car economically.

Fits all cars. Permanently mounted. Checks Spark Plugs, Carburetor and 31 other Motor adjustments. Shows how to increase miles per gallon at every speed. 1 to 5 minute installation — 4 color Easy-To-Read Dial. No holes to drill. Mounting bracket fits dash or windshield frame. No experience needed. Complete instructions and 16-page mileage book included. Tested and proved by leading Automotive Associations and manufacturers. Makes a perfect gift. (Beautifully gift wrapped at no charge.) Over 1,000,000 in use today.

SURE ACCURACY AT ALL SPEEDS

Send for yours, today — Mile-O-Meter shipped prepaid — money back guarantee

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Standard Model 2¾ Dia. . . . . **$9.75** Ppd.

Fed. Tax Incl.

Mile-O-Meter will tell you how to correct the engine condition.

Certified Test Performance Certificate **1950** CERTIFIED APPROVED

money back guarantee

order from GALE HALL ENG., Inc.

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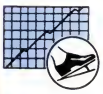
Boston 18, Mass.

1. TEACHES you how to drive economically—eliminates the Jack Rabbit starts and passing on hills — that's where you really drink up fuel.



2. PERFORMANCE charts and suggestions are enclosed with every meter, enabling you to determine how many miles per gallon you are getting, and what adjustments to make to increase your mileage.

3. YOU can check your engine condition at all times, and if it is not operating efficiently, Mile-O-Meter will tell you how to correct the condition.

4. SIMPLY mount meter on windshield frame or on dashboard area to suit your convenience with the aid of mounting brackets that can be bent into practically any position.

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For
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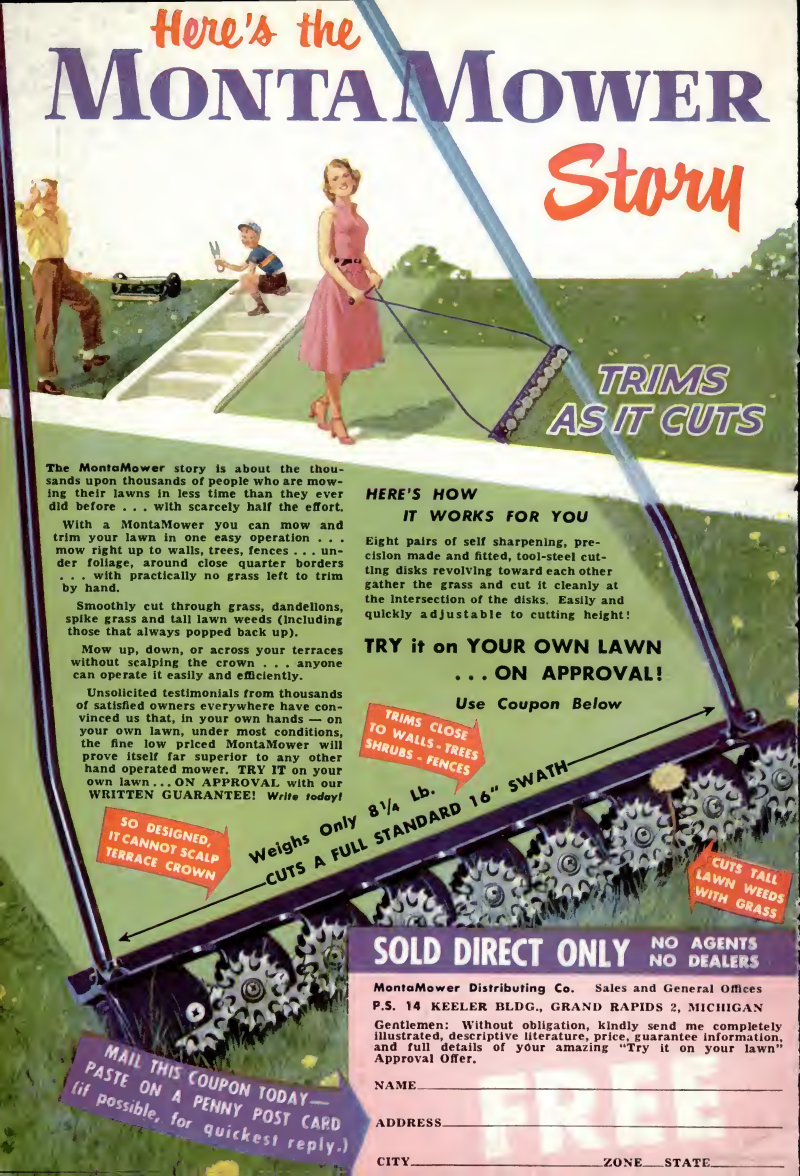
175 Bloor Street, East
Toronto 5, Ontario

In Canada
$17.95 Ppd. $11.95 Ppd.

Copr. 1951

Here's the MONTAMOWER Story



The MontaMower story is about the thousands upon thousands of people who are mowing their lawns in less time than they ever did before . . . with scarcely half the effort.

With a MontaMower you can mow and trim your lawn in one easy operation . . . mow right up to walls, trees, fences . . . under foliage, around close quarter borders . . . with practically no grass left to trim by hand.

Smoothly cut through grass, dandelions, spike grass and tall lawn weeds (including those that always popped back up).

Mow up, down, or across your terraces without scalping the crown . . . anyone can operate it easily and efficiently.

Unsolicited testimonials from thousands of satisfied owners everywhere have convinced us that, in your own hands — on your own lawn, under most conditions, the fine low priced MontaMower will prove itself far superior to any other hand operated mower. TRY IT on your own lawn . . . ON APPROVAL with our WRITTEN GUARANTEE! *Write today!*

HERE'S HOW IT WORKS FOR YOU

Eight pairs of self sharpening, precision made and fitted, tool-steel cutting disks revolving toward each other gather the grass and cut it cleanly at the intersection of the disks. Easily and quickly adjustable to cutting height!

TRY it on YOUR OWN LAWN . . . ON APPROVAL!

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Gentlemen: Without obligation, kindly send me completely illustrated, descriptive literature, price, guarantee information, and full details of your amazing "Try it on your lawn" Approval Offer.

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MAIL THIS COUPON TODAY— PASTE ON A PENNY POST CARD (if possible, for quickest reply.)